PRODUCTS finishing

Volume 10 JULY, 1946 Number 10

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CONTENTS

Editorial 27

For Greater Efficiency with Polishing and Buffing Compounds 28
By FRANK V. FAULHABER

Grinding, Lap and Scrape Finishes at Vinco..... 40
By BRYANT W. POCOCK

Glycerine in Anodic Treatment of Aluminum.... 50
By GEORGIA LEFFINGWELL and MILTON A. LESSER

Transit Vehicle Finishing 60

Finishing Clinic 62
By DR. ALLEN G. GRAY

Metal Plating in Pre-Columbian America..... 74
By EUGENE W. NELSON

News of the Industry..... 82

New Equipment and Materials..... 90

Opportunity Section 106

The Finishing Touch 108

Catalog Library 110

Index to Advertisements.....112

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Products finishing

A Balanced Finish--

The selection of a finish is dependent on the requirements for the end use of the finished article as well as the shop conditions available. It must be a balanced finish in which an outstanding property in one characteristic is not gained at the sacrifice of other properties of equal importance. It must be one in which all property characteristics pertinent to the use of the finished article are brought to a high level of performance. Many different factors, therefore, require consideration in selecting finishing systems for such items as refriqerators, washing machines, stoves, automobiles, kitchen cabinets, electrical equipment, and agricultural machinery.

Many problems face manufacturers of metal parts requiring proper finishes to adequately meet their service requirements. Larger consumers of finishes usually have some form of technical organization to assume responsibility for the evaluation of finishes for their special use. However, in practically all such cases the finish manufacturer has a very cooperative technical liaison with him to achieve cooperation in the full development for utmost performance and utility of these finishes.

Consumers of smaller quantities of finishes cannot ordinarily afford the technical personnel to adequately study and evaluate these finish problems and are, as a result, largely dependent on the advice and help of the supplier. It is important then, in the selection of a balanced finish, that the finish supplier be one who is in a position to render practical constructive help based on a wide experience.

Users of finishing materials will usually find their supplier to be greatly interested in his customer's problem of enhancing the value of his product with balanced finishes of superior performance at the lowest unit cost. This may often include the ability and willingness to assist in the development of the most effective means of application. The finishing engineer should not confuse the objective of reaching the lowest unit cost for a balanced finish with a low cost finish. In many cases, it will be found that finishes that are higher in gallon cost, when properly used, may result in the lowest unit cost finish and greatest satisfaction.

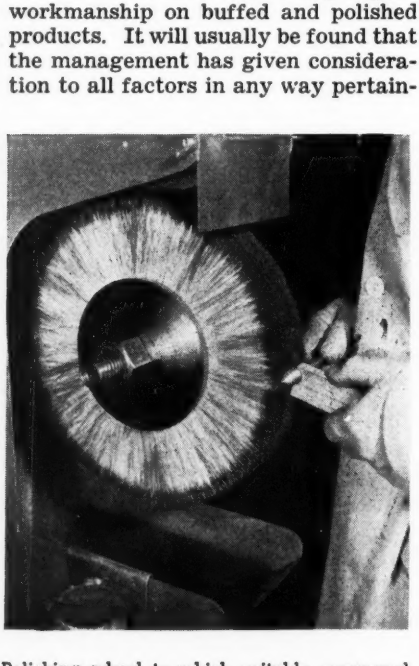
Through the cooperation of service engineers with manufacturers' operating finishing personnel, the increased value of further improvements in balanced finishes, based on new developments in plastics and sythetics resins, can be achieved.

JULY, 1946 **Vol. 10, No. 10**

For Greater Efficiency with POLISHING AND BUFFING COMPOUNDS

By FRANK V. FAULHABER

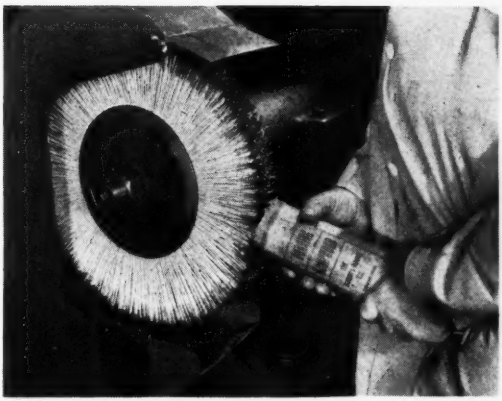
As with any other type of finishing operation, buffing and polishing present their particular problems. Some plants are noted for their consistently superb workmanship on buffed and polished products. It will usually be found that the management has given consideration to all factors in any way pertaining to the work. There is a definite discretion as regards choice of buffing and polishing materials. Indiscriminate, hit-and-miss selection is unequivocally taboo. Those invested with the responsibility have sound, valid reasons upholding their judgment.



Polishing wheel to which suitable compound has been applied is shown being used in polishing a threaded part.
(Photo courtesy The Roberts Rouge Co., Stratford, Conn.)

These problems become of increasing import in view of the persistent demand for better finishes and the unceasing search for finer surfaced work. In seeking suitable buffing and polishing compounds, many details alone must have bearing before deciding on a purchase. Is the aim a better appearing product, in the interest of more sales? Is the object greater durability? To lessen porosity of surface? To ensure resistance to corrosion? To expedite examination of the product? To achieve mechanical fineness?

Does the buffed or polished surface complete the work, or is there a succeeding operation, such as coloring, cleaning for plating, lacquering, or enameling? What metal is to be used? Just what kind of parts are to be polished or buffed? In what condition is the surface preceding the buffing operation? What class or type of finish is desired? What is the spindle speed, the type, diameter and the texture, construction and density of the



Burring compound is shown being applied to a wheel to be used in polishing metal parts. *(Photo courtesy The Roberts Rouge Co., Stratford, Conn.)*

buff or polishing wheel? Is the buffing to be done by hand or an automatic machine? If subsequently the work is to be cleaned, will this be by means of solvent, soap or alkaline cleaner? If the latter, will this be by still or electrocleaning? What will be the temperature of the cleaning tank and the duration of immersal? Is this cleaning to be one of scrubbing?

Is a mechanical holder to be used for the work? If so, what are the precise dimensions of the cake necessary, giving consideration also to permissible tolerances?

Just a few relevant questions, and they do not relate to the individual qualities or superiorities of the buffing or polishing compounds themselves. Yet, they must all come within range of review before any given composition can be considered for any one job. In far too many instances the most superlative compound, indeficient as it may be for its intended job, fails because it is being used on the wrong type of work; the operator takes a chance, he uses it in a pinch or as a substitute. Aftermath: unsatisfactory work, complaints, lamentation, lost business.

When buffing or coloring metallic or non-metallic surfaces, the time and energy entailed, the usage on buff, the character of the finish and the number of pieces polished per hour are all influenced by the kind of buffing or polishing compound in use. The materials available at the most appealing prices per pound may be the most appropriate to use, and yet in the end prove the most expensive by reason of severe buff wear, excessive rejects, extreme cleaning costs, and high labor expense per unit. Reversely, an expensive compound does not necessarily signify a suitable polishing agent if its performance possibilities have not been considered.

Importantly, high operating speeds and pressures, such as hand operations at high peripheral speeds, and particularly all automatic buffing machines require high melting point compositions, with sufficient lubricating properties—strong, tough cakes with fine, uniform texture, containing tripoli powder only, free from sharp silica, flint, or other hard abrasives. Contrariwise, low peripheral speeds call for lower melting point compositions, softer texture, and frequently require the blending of various abrasives for superior workmanship.

Cleaning procedures of a plant have appreciable bearing on the type of composition most suitable. Where a mild cleaner is in use, the binder—notably, the oils, fats and waxes in the composition—should be of such a quality as to ensure quick and easy emulsification. Whenever harsh cleaners are used, or the nature of the part is such

that it is easy to clean, a plater, for instance, can allow the polishing operator a wider latitude in using what he wishes without inviting troubles. Where the practice is to use solvent cleaners, an even wider leeway may be permitted. This may also apply in such cases where the work is

In this illustration, a combination burring and finishing operation is shown being performed on metal housings.
(Photo courtesy The Lea Manufacturing Co., Waterbury, Conn.)

given a soaking in an emulsion cleaner prior to cleaning with alkalies.

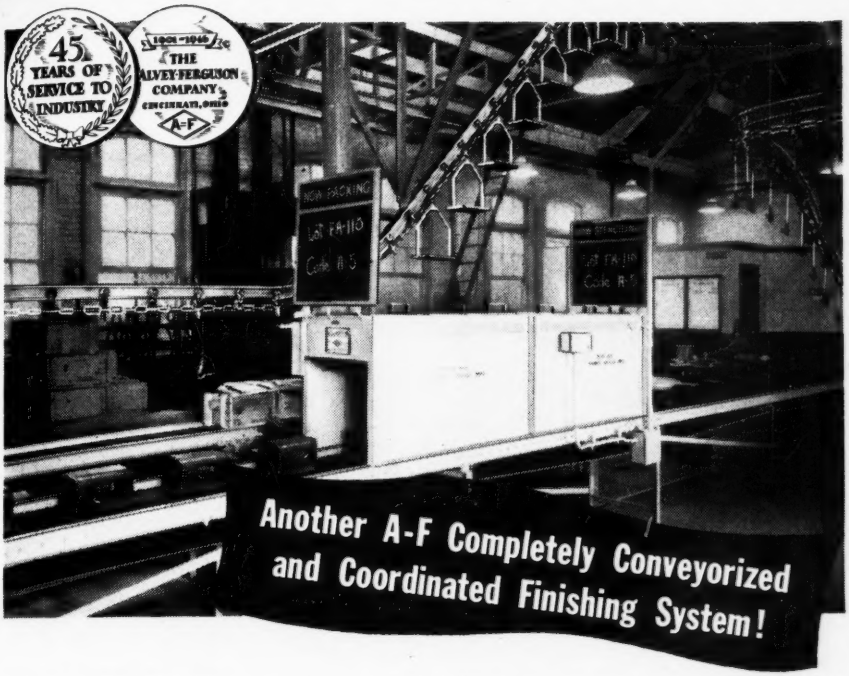
Concordantly, drawing compounds, stamping or press oils and greases must be borne in mind. A grease or polishing compound employed for oiling operations and the grease or compound that is put on the polishing wheel all have bearing on the ultimate work. When drawing and stamping greases are insoluble and removed in tanks later serving for cleaning polished or buffed units, there will be cleaning problems when achieving the final finish.

Virtually all buffing compounds leave a film of grease on the work and the thickness of this film depends on the type of composition. It is essential particularly when preparing the work for plating, that this film be easily removable with an alkali cleaner prior to plating. This problem is frequently experienced when employing lime coloring compositions on nickel plate

When the finishing plant uses a buffing compound incorporating just enough grease to hold the abrasive on the wheel without any grease being retained on the work, cleaning difficulties are lessened. To overcome any problems of slaking when buffing nickel plate, a composition containing unfused aluminous oxide will serve excellently.

In manufacturing buffing and polishing compounds, the elimination of impurities from the ingredients to be used represents a vital problem. Frequently, vegetable waxes include pieces of twigs and leaves from the plant which produced them. The manufactured waxes may contain various foreign detrimental materials, such as lint from filter presses. Bits of paper, burlap or cloth may have been torn off from bags; entailed also is vigilance to intercept wood splinters or nails from boxes and barrels. If permitted to end up in the completed cake, some of these impurities can prove a serious hazard to the buff or to the operator.

The modern buffing and polishing compound manufacturers exercise meticulous care and precaution to assure users high-quality, dependable products. Efficient removal of dusts is accomplished through the use of the latest and best exhaust systems at every stage of the operations. The ever-present aim is to exclude from the compositions all substances not intended to enter and that in any way



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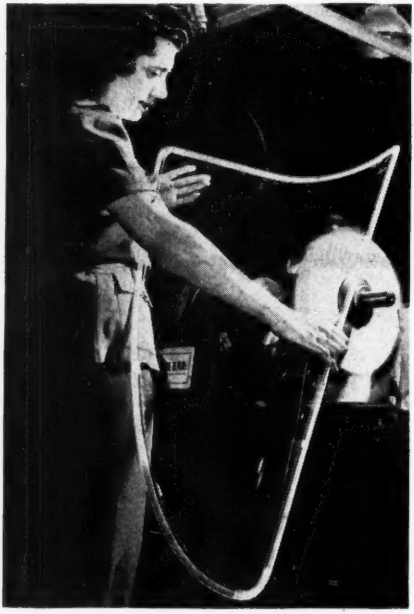
might have an adverse affect when using.

An abrasive selected for the first or polishing operation influences in large measure the final operations and the final finish. The selection of this initial compound is therefore of no small significance, giving due consideration to correct type and size of



The operator shown herein is buffing a Plexiglas turret component.
(Photo courtesy The Lea Manufacturing Co., Waterbury, Conn.)

abrasive. Greater efficiency and more economical operation will be the rule when the first grain size is the appropriate one to successfully remove the base surface; the succeeding operation calling for the next size for removal of such marks and defects as may have been left by the preceding grain, then proceeding until the first buffing, for which a tripoli composition will serve.

In tripoli compositions, the main ingredients are siliceous materials, produced in three different grindings or size of particles: sharp or crystalline silica, also known as flint; amorphous or cryptocrystalline silica. A small percentage of other abrasives is sometimes added. Tripoli is high in silica, but, by reason of its crystal formation, markedly varies from either crystalline or amorphous silica. Devoid of sharp crystal faces, tripoli grains are soft, porous, and crush down when buffing, leaving fresh polishing surfaces to the metal.

Tough enough to reduce and remove smaller superficial scratches, pits and defects on metallic surfaces, tripoli also produces a fine, smooth surface. It is most effective for polishing nonferrous metals, whereby simultaneously the material may be reduced and colored. In the metal-finishing industry, tripoli is generally considered as a proven reliable standby for buffing.

Stearic acid is also frequently used in buffing compositions to supply the necessary toughness, texture and wearing properties; tallow, in different grades, to ensure lubrication for the buff; and petroleum, of various kinds, for adhesiveness. Then, there is a divers run of mineral, animal and vegetable oils, fats and waxes that impart desirable qualities to befit individual specific buffing problems.

Certain metals, such as aluminum, die-cast metals and other low-melting point alloys, require compositions supplying a liberal amount of lubrication to prevent scratching, tearing and overheating. Tougher, harder abrasives, on the other hand, are proper mediums for surfacing ferrous metals.

For polishing units of copper and brass in irregular form, making it difficult to achieve a high polish, the procedure usually is to reduce initially by means of a stitched buff operated at high peripheral speed. The operator should use an abrasive that will

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actually cut and remove the metal so as to free the surface of any marks produced at the starting operation. The coloring operation can next be performed by the aid of a loose-leaf buff, using an appropriate coloring composition.

It has been universal practice in finishing circles to use a white color-

In using a compound on this buffing and polishing lathe, the attached composition applicator serves as an efficient auxiliary. *(Photo courtesy Divine Brothers Co., Utica, N. Y.)*

ing composition for the final finishing or coloring operation on non-ferrous metals, also on celluloid, bone, ivory, and a variety of hard or soft plastics, bakelite, hard rubber, and occasionally on copper-plated parts. Inasmuch as coloring compositions have negligible cutting properties, serving rather to burnish, the working surface must be in a receptive condition for proper coloring. Therefore, a tripoli buffing operation usually precedes, particularly when processing non-ferrous metals. For this purpose, full-disc loose buffs serve very well, operated at medium peripheral speeds, using light pressure.

When coloring operations are being performed with automatic buffing machines, extra heavy duty compositions will function more efficiently, since these possess more lubricative ability, essential to obviate overheating under the conditions.

In many establishments, chromium plated parts must be buffed. The units sometimes require but a light wiping action to remove stains and bring out a superb, brilliant finish for final inspection. There will be times when a section of the surface has a frosted appearance, usually due to a heavier deposit in that area. Inasmuch as chromium is rather tough, the composition to be effective must have a strong cutting or buffing action, without, however, producing scratches. For this purpose, there are available compositions incorporating very fine abrasives, the white compositions being pure alumina and the green compositions, chrome oxides.

Generally, the hard chrome deposits on tools, gages and kindred products are not buffed, and various parts that are lightly chrome plated for decorative or corrosion-resistance purposes require no buffing, since they issue from the final rinse tank clean and bright enough to meet specifications.

Since the management of the progressive finishing plant methodically is concerned with reducing overhead, it is well to bear in mind that the type and quality of buffing and polishing compounds used has appreciable bearing on the facility of cleaning, an operation pronouncedly expensive in some plants. Once the most suitable and effective cleaning procedures have been decided on, considering all fac-

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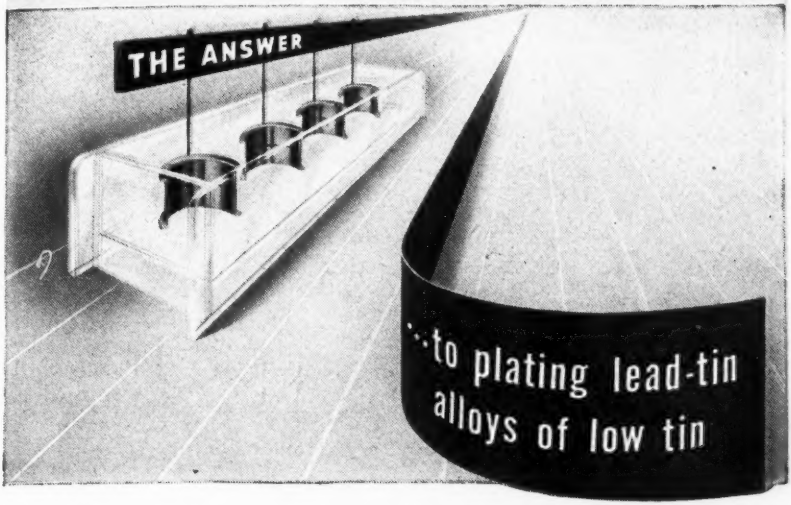

For more than 25 years metal finishers have sought a successful means of plating lead-tin alloys in the low tin ranges. "Not feasible . . . inoperable . . . too many variables," read published reports on method after method.

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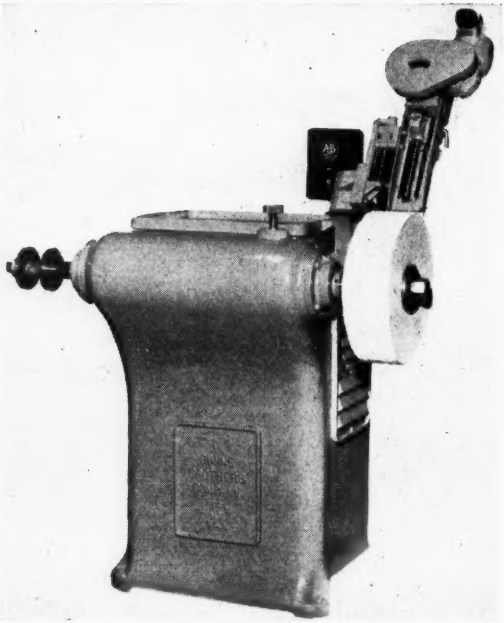

This illustration shows a buffing and polishing lathe equipped with a composition applicator, the applicator being in the proper position for applying compound to the polishing wheel.

(Photo courtesy Divine Brothers Co., Utica, N. Y.)

tors, tests should be undertaken to determine the proper compositions which will assure not only the desired polishing or cutting action, but which will also line up scientifically to best effect with the plant's cleaning processes.

Relevantly, buffing dirt in the finishing shop consists of abrasive powders, lint, grease of divers sorts and also charred or partially carbonized lint and charred or partially burned oils, fats and waxes which were resident in the buffing composition. Noteworthily, whenever this charred mass is packed by tremendous pressure into holes and depressions during buffing operations, some means must be found to dislodge such hard-packed substances before the article can be cleaned properly.

When pricing buffing and polishing compounds, bear in mind that the cost of a compound really represents but a nominal portion of the complete expense of a given job. Buffs, wheels, power, labor, cleaning, plating, and miscellaneous outlay attending the polishing operations all must be considered. Admittedly, it is of paramount importance to purchase the most indeficient buffing compositions obtainable for a specific operation. Compounds of the correct qualities enable the management to hold buff wear to a minimum, cut labor expenses, solve otherwise perplexing cleaning difficulties, and reduce rejects to a negligible percentage, thereby making possible the best possible buffing or polishing job at the lowest possible cost.

When testing buffing and polishing compounds, the management does well to assign such experiments to various operators to more correctly determine the true values of the products. Individual idiosyncracies may sway or influence one operator as to the real merits of a compound. When several operators uphold or condemn a new composition just put to the test, a more reliable guide may be had as to its intrinsic qualities, for the men are practically certain to express themselves on what they can or cannot do with it.

If those in charge of the finishing department nurture any dubiety as to their operators' opinions of a tested composition, the material assuredly warrants further experiment if they

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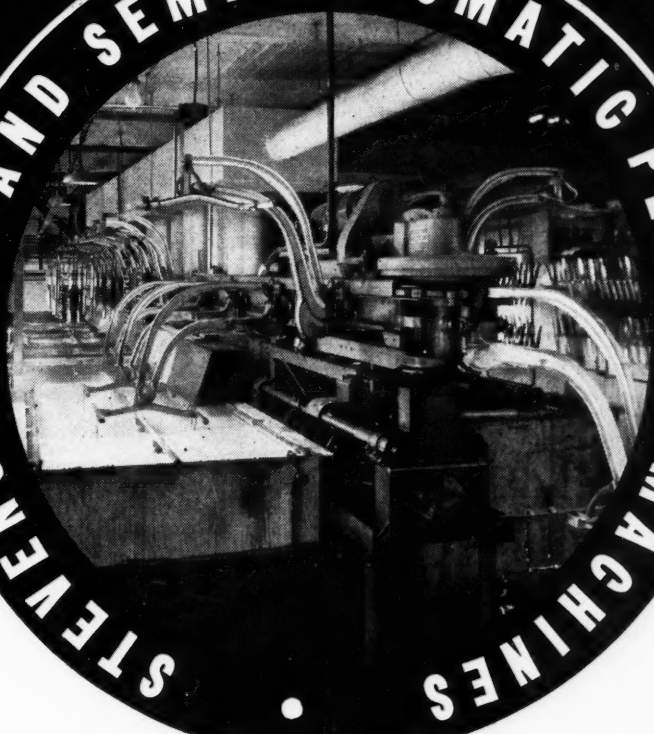

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deem it so deserves. Put it to a genuine production test, maintaining detailed and complete data in connection with its use. The following are pertinent points to keep in mind when conducting such an experiment:

1. Record the number of parts or pieces per hour, per man and per day.

2. Stage the test for at least a day; if possible, a week.

3. Begin with new buffs, weighing them before and after the test to determine the actual service and amount of wear.

4. Weight the compositions to be used and the nubbins remaining to determine the weight of the composition used.

5. Retain accurate, systematic records as respects the volume of work accomplished: the number of units buffed and the number of rejects for the given operation.

6. Consider the cleaning operation carefully as relates to facility of cleaning, number of "doubtfuls" or rejects, quantity of cleaner required.

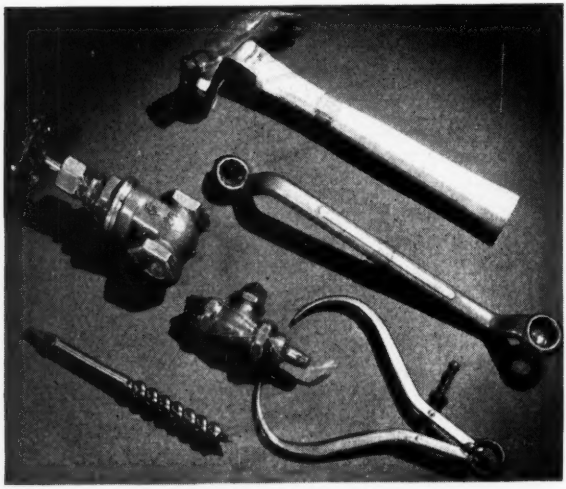
7. Gage the quality of workmanship, the appearance of the output.

8. Evaluate the cost of buffs and compositions used, the cost of labor, cleaning operations, and so on, per unit of production.

9. Stage a special meeting, analyzing the results, interchanging ideas and suggestions, for dependable guidance as to the prospects of the tested compositions.

Experienced operators do not remove the complete metal foil jacket from a compound. They tear it away as a bar is used. They keep the exposed end covered with the metal cap when not using the compound. Overexposed to the air, a compound tends to become dry and hard. A brief soaking in water can restore a hardened composition to its original condition unless exposure has been overlong.

During hot weather, store compounds in a cool place or refrigerator. Prolonged exposure to heat induces deterioration and excessive waste when using. Storage space should never be under freezing nor above 80 deg. F. in temperature.



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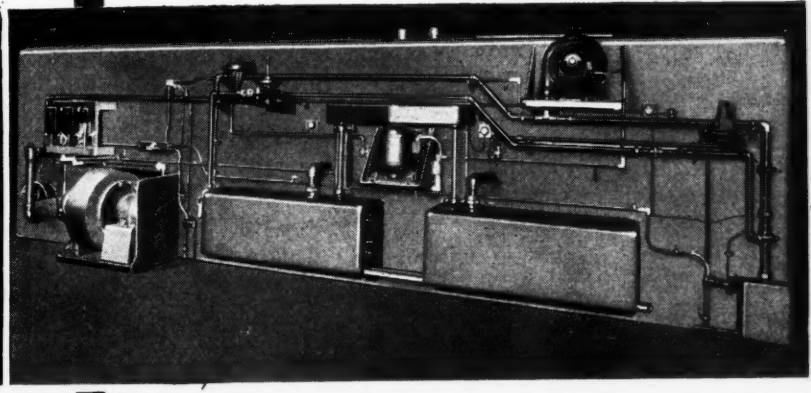

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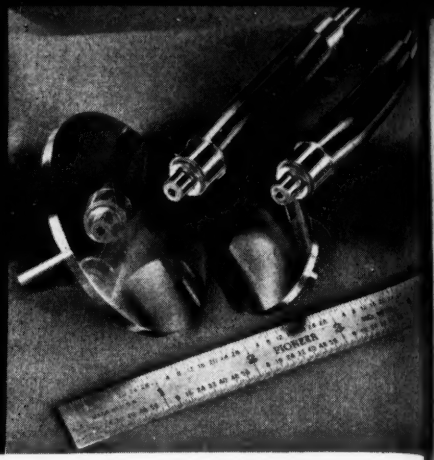
Grinding, Lap and Scrape Finishes at Vinco



By BRYANT W. POCOCK

EXECUTIVES of Detroit's Vinco Corporation, 8855 Schaefer Highway, are wont to define their firm's primary function as consisting of the manufacture of gages and precision inspection equipment. The company's advertising slogan, "Millionths of an Inch for Sale," stresses the importance which Vinco attaches to the adjective, precision. Considering that the wavelength of yellow light is of the order of 23 millionths of an inch, anything below this figure would involve precision. The firm's engineers are satisfied, however, that they can produce finished surfaces accurate to within 2 millionths of an inch. They actually guarantee 4 millionths (Fig. 1). It is interesting to observe by way of comparison that the National Bureau of Standards views any optical surface accurate to a quarter wave as being extremely precise.

It is one thing to produce a very fine finish and quite another to hold very fine accuracy. The ability to do both these things and to combine them in a single product on a production level in a competitive market is Vinco's chief claim to pride and distinction among American manufacturing firms.

In order to produce the finest possible luster in lapping flat work, Vinco operators start with a wet lap using a fine lapping cream. Work is continued until nearly complete, whereupon final lapping is done by means of a few strokes of the work on a dry lap to provide the highest possible gloss. Although the purpose of the

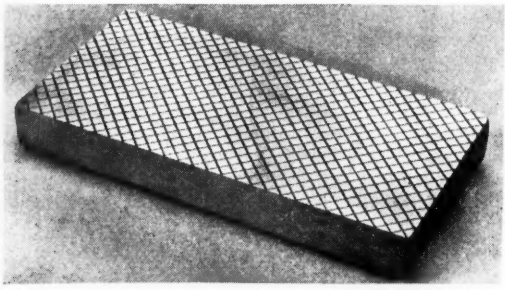


Fig. 2 — Channeled cast iron lap used at Vinco Corporation for lapping flat surfaces

Fig. 3—Typical channeled male and female laps used at Vinco Corporation for lapping cylindrical surfaces

channels cut in cast iron laps (Figs. 2 and 3) is to form troughs to facilitate proper distribution of the abrasive material, it is not felt at Vinco that either the depth or the frequency of channels is of particular importance. Lapping is not fundamentally an abrasive action, as in grinding, for the surface is worn away by clean cutting or planing rather than by crushing. For a thorough technical discussion of the differences, see Lord Rayleigh's paper.[1]

Clearances in the dresser cross slide and dovetail assembly for Vinco's B-1 radius dresser are held to plus or minus 50 millionths of an inch. These are lapped together at assembly to a condition of free action using so-called green rouge (finer than red rouge) held in suspension in olive oil. Olive oil is chosen because of its low evaporation and non-drying properties.

Cross-axis lapping as employed at Vinco produces an extremely fine satin finish characterized by pleasing eye appeal, due largely to irregular reflection of light (Fig. 4). Cross-axis lapping possesses the further advantage that it can be done unusually fast. It is applied in the case of cylindrical and conical exterior surfaces by holding the work against a wheel rim with the axis of the work off 90 degrees with respect to the face of the wheel. The angle made with the wheel may vary with the O. D. of the work, but it is readily determined by "feel".

Experience at Vinco indicates that nickel iron laps can be hardened to from 35 to 42 Rockwell C and still take a charge of polishing compound.

The optical dividing head as developed and manufactured by Vinco is a precision inspection instrument designed for use in checking annular spacings of gears, splines, and so on, to an accuracy of within 2 seconds of arc. Company engineers, referring to this instrument picture its finely scribed disc as possessing an exceptional finish. This disc, received as a tool steel forging, is rough machined,

[1] Lord Rayleigh, *Proc. Roy. Inst. Gr. Britain*, March, 1901; *Trans. Opt. Soc.*, 19, Oct. 1917.

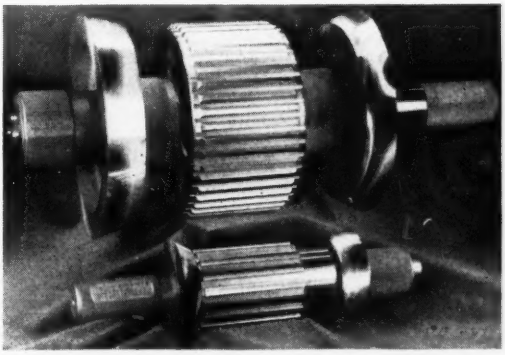


Fig. 4 — Aviation propeller hub gages manufactured by Vinco Corporation. Note the irregular reflection of light caused by fine satin finish produced by cross-axis lapping.

heat treated, and finish machined, then oil hardened to 58 to 62 Rockwell C. It is then flat ground and its bore is circular ground.

The master disc bore is lapped on a channeled lap supported by a tapered spindle. Number 600 Alundum paste is used to charge the lap. Laps are made of a nickel cast iron, free from blowholes. The lap is rotated horizontally about 60 to 100 r. p. m. The work is grasped firmly with the hands and kept from rotating while it is made to slide back and forth along the lap, this operation eventually providing for the removal of about 0.0001 to 0.0002 inch on a side.

A pair of discs, which in operation are eventually made to act as a vernier against each other, is ground together in order to ensure identity of the edged surfaces. The discs, which have a 12-inch diameter, are rotated about 60 r. p. m. during this grinding, the wheel a minimum of 1,500 r. p. m. A soluble oil is used to facilitate grinding.

Gear rolling fixtures (Fig. 5) are produced at Vinco as precision devices for the inspection of all ordinary types of spur and worm gears. These are made from iron castings, with steel bushings inserted at predetermined locations. In use, a master gear and a part gear to be checked against the master are mounted on adapters, the gears are brought into mesh under constant load and rolled against each other, and any eccentricity of the part gear is read from a dial indicator. Other features enable the operator to check backlash.

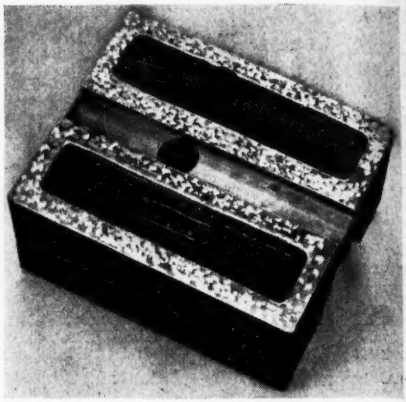


Fig 6—Example of scraped finish produced by Vinco Corporation. This finish is ornamental as well as constituting a mechanically flat surface.

All essential elements of gear rolling fixtures are hardened, ground and lapped to tolerances under one ten thousandths of an inch, and are held to gage fits in assembly. A interesting adaptation of lapping occurs during the construction of these devices where two holes, one directly above the other, are lapped simultaneously.

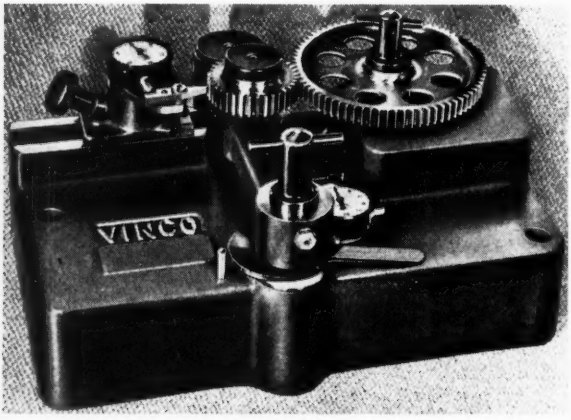


Fig. 5—Precision gear rolling inspection fixture manufactured by Vinco Corporation. All essential elements are lapped to tolerances under one ten thousandth of an inch.

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GET THE FACTS . . . *Write for Bulletin 202*

EP X-12

THE ELECTRIC PRODUCTS COMPANY
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Fig. 7—View of Vinco Corporation's inspection department. The temperature of the entire room is maintained at 68 deg. Fahrenheit.

A circular, channeled cast iron lap is fitted into the top hole first, then into the bottom hole by hand. A tapered spindle is next inserted into the bore of the lap (the lap being in the form of a split cylinder and hence expandable) and tapped until the lap has expanded just enough to fit perfectly. The lap is then charged and poilshing is begun. Plug gages made by Vinco and varying one ten thousandths of an inch in O. D., are used as checks. The tooth form is accurate to within 2 ten thousandths of an inch, and the spacing error between any three meshing teeth is less than 2 ten thousandths of an inch.

Many of Vinco's finished surfaces cannot be lapped, thus necessitating fine grinding to finish. As an exquisite example of such ground-finish surfaces might be cited the tiny (0.060-inch O. D.) 8-spline plugs manufactured by Vinco during the late war for use in checking the timing mechanisms of aerial and submarine torpedoes. The thickness of spline teeth was 10 thousandths, and the entire plug was finished on a hand-operated surface grinder using No. 38180-K Norton wheel. Internally ground punches, made by Vinco for an automotive concern which uses them for pressing out powdered metal for Oilite gears and bearings, are likewise completely finished by grinding. A Norton 3846-J wheel, with an O. D. of about ⅔ the I. D. of the work, is used.

It is felt at Vinco that proper methods of grinding enormously reduce the amount of time subsequently spent in lapping. The following points in

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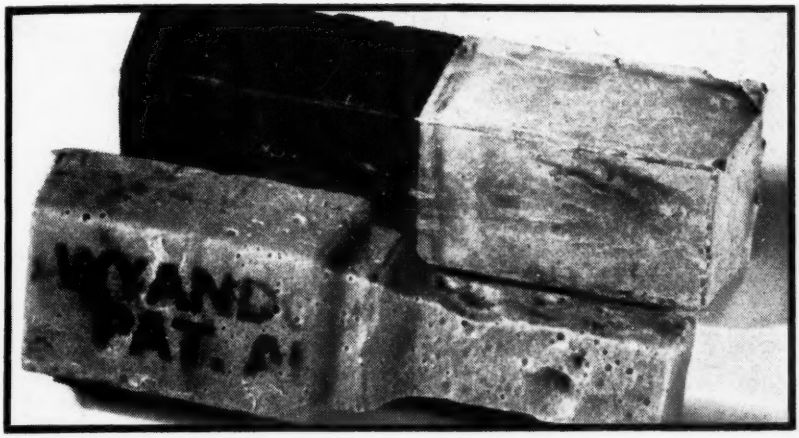

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Shown above are two bars of buffing compounds—a Wyandotte bar and a representative competitive bar. Both measure approximately 2″x2½″x8″. Both bars were given identical treatment—(1) 30-minute partial immersion in tap water, 125° F. and (2) 10-minute partial immersion in sulphuric acid solution 2½% by volume, room temperature.

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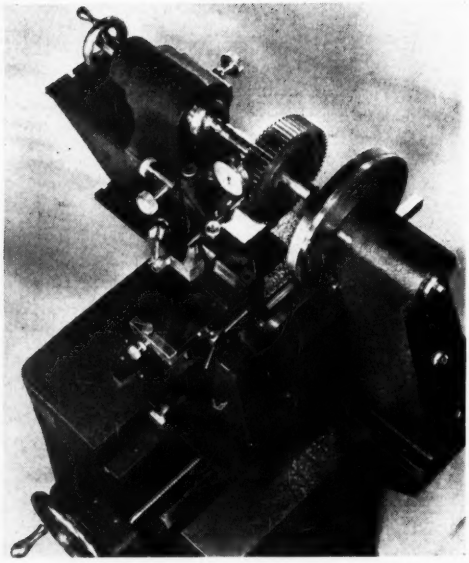

Fig. 8—Precision involute checking instrument manufactured by Vinco Corporation

particular are considered of paramount importance in producing a fine ground surface on flat work:

1. Properly dress wheel. Use a slightly rounded diamond. Take 5 thousandths of an inch off the wheel at a time, followed by a final cut removing 1.5 thousandths. Use a constant, slow speed of diamond travel across the face of the wheel, best produced by putting a drag on the feed by pressure applied with the hand.

2. Even travel of the work under the wheel.

3. Proper feed of the work. A recommended feed is about 30 thousandths parallel to the spindle for each cut.

4. Selection of the proper grit size. This is often a matter of the operator's preference. For example, one Vinco operator stated his preference for Norton's No. 3846-H-8BE grit for final grind but admitted that this is not necessarily universal even in his own department.

In grinding involute splines and spur gears, Vinco uses the formed wheel method to produce excellent finish. The generating method, however, must be used for helical gears and helical involute splines. The formed wheel method makes use of a grinding wheel dressed by an involute formed wheel dresser. The working periphery of the wheel thus assumes the full involute shape and operates in

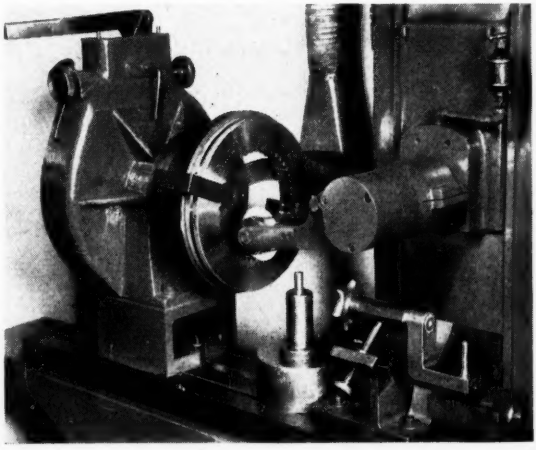

Fig. 9—Special attachment developed by Vinco Corporation for the internal grinding of splines

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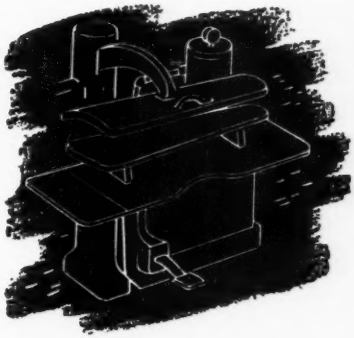

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complete contact with the workpiece.

Scraped finish, which is fundamentally functional and secondarily beautiful, is produced at Vinco as elsewhere for the formation of truly flat surfaces of cast iron. The ancient and original method introduced into the United States nearly a century ago by Sir Joseph Whitworth and used today unaltered is fully described in the January 1944 issue of "Tool & Die

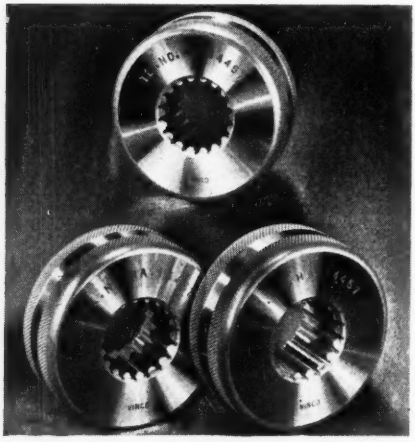

Fig. 10—Serration spline ring gages manufactured by Vinco Corporation

Journal".[2] The essential features are as follows:

Originally, three surface plates are required which, when properly scraped together, will ultimately become master flat surface plates. In addition to these, a scraping tool and a supply of blueing are needed. The following steps are carried out in order:

1. Plates 1 and 2 are scraped equally to agreement.
2. Plate 3 is scraped to agreement with 1. Scrape 3 only.
3. Plates 2 and 3 are scraped equally to agreement.
4. Plate 1 is scraped to agreement with 2. Scrape 1 only.
5. Plates 1 and 3 are scraped equally to agreement.
6. Plate 2 is scraped to agreement with 3. Scrape 2 only.

The above cycle of steps is repeated until the desired degree of precision has been reached. A satisfactory scraping tool can be made from an ordinary flat file by grinding a sharp curvature on the end, having a 6 to 8-inch radius. Smaller spots may require a shorter radius.

Once a master plate has been produced, work may be scraped to agreement with it. At Vinco, red lead is applied to the surface of the work, the latter is turned face down on the master plate and rubbed back and forth. After a reasonable amount of rubbing, the work is turned over and examined. Any black spots on the work are high spots, which are removed with the scraping tool. This process is continued until the surface is finished. Beautiful finishes are produced in this manner on tiffinite cast iron (Fig. 6), which have the advantage of constituting extremely flat surfaces.

Figure 7 shows Vinco's large inspection room, which is maintained at a constant temperature of 68 deg. F. By means of equipment contained in this room, it is possible to check the quality of surface finish to one micro-inch. This, as was pointed out above, is 1/23 the wavelength of light and is accurate enough for all purposes.

Jelliff Dipping Baskets. A six-page folder providing illustrated, descriptive, and tabular data on 14 standard designs of dipping baskets for cleaning and pickling operations has been prepared by The C. O. Jelliff Manufacturing Corp., Southport, Conn. Several different types of special baskets made to specifications and fabricated by Jelliff are also depicted in the folder, copy of which is available free upon request.

[2] "Accuracy and the Geometry of Precision —Part II," by E. Willard Pennington, Technical Editor, *Tool & Die Journal*, January 1944.

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(Above) Bank of G-E "500" Rectifiers, showing compact multiple-unit arrangement.

GENERAL ELECTRIC

Glycerine in Anodic Treatment of Aluminum

By GEORGIA LEFFINGWELL, PH.D. and MILTON A. LESSER, B.Sc.
UTPS Correspondents

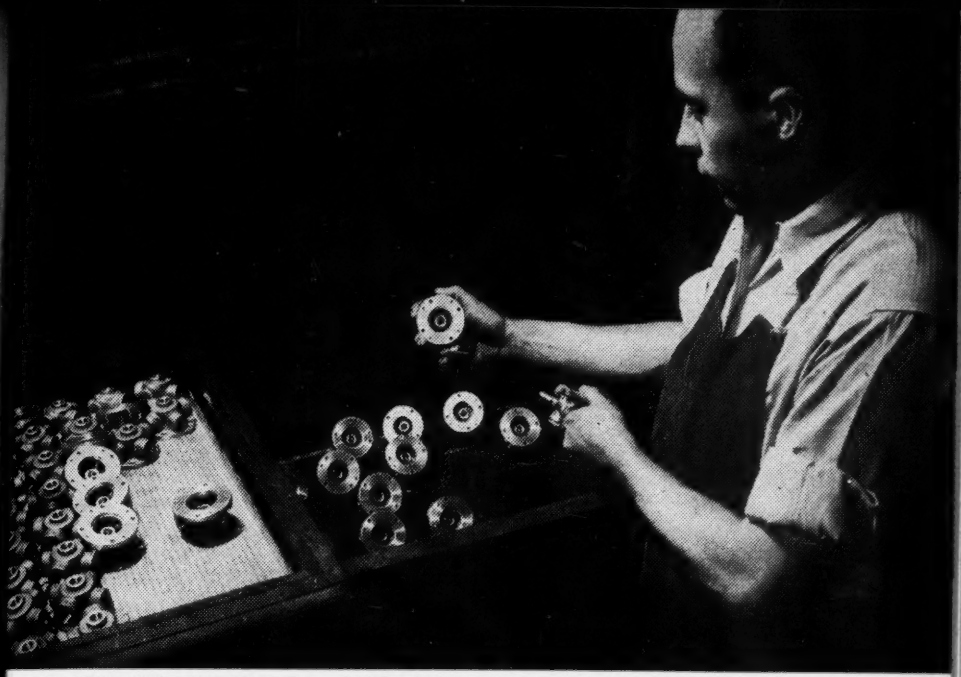
ALTHOUGH glycerine is finding new and important uses in the field of electrochemistry, this fluid has long had a well-established place in processes for the anodic treatment of aluminum. Moreover, as new processes of this type have been developed or improvements are made in older anodic methods, glycerine has continued to be specified as a requisite material.

It is now well appreciated that the oxide coatings formed on aluminum by anodic treatment in various electrolytes, many of them containing glycerine, comprise a most important type of finish for this useful metal (1). As remarked by Young (2), aluminum is a rather active element and is always covered with a thin film formed by reaction of the metal with atmospheric oxygen. Unfortunately, this natural coating is so thin as to offer but little resistance to corrosion or abrasion.

However, by the use of suitable methods, it is possible to form a thicker, highly protective oxide film. This is done by making the metal an anode in an appropriate electrolytic solution. This anodic process differs from electroplating in that the materials to be treated are attached electrically as the anode rather than the cathode in the electrolyte. As is well known, an electric current through the solution causes release of oxygen at the anode, while hydrogen is given off at the cathode. Some of this liberated oxygen combines with the metal to form aluminum oxide, integral with the surface of the metal.

The oxide film so formed is very hard, having a rating of about 8 on Moh's hardness scale. In addition, this coating is very resistant to corrosion. Thus, the production of an oxide coating of appreciable thickness not only affords protection against corrosion, but against abrasion as well (2). The properties of these aluminum films will vary, however, according to such factors as: the composition of the alloy, the composition of the electrolyte, and the time, temperature, and voltage of the operation (3).

Glycerine is a standard component of solutions used in the anodic treatment of aluminum. Employed in varying proportions in the electrolytic bath, glycerine generally acts as an inhibiting agent. In this role, it serves to prevent undue etching and thereby helps to provide a finer, whiter, and smoother surface (2, 4). In sulfuric acid baths, perhaps the most important methods for anodic oxidation, the addition of glycerine is reported (5) to decrease the solubility of aluminum and to facilitate the formation of a more plastic film.



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The hard corundum-like coatings formed on aluminum by anodic methods are among the most durable of modern finishes affording protection and permanence. These finishes not only provide an attractive appearance, high corrosion resistance, high dielectric strength, and high reflectivity, but they also afford good absorption for dyes and mineral pigments (3). Beautiful and highly decorative finishes can be obtained by coloring the anodized layers with suitable dye solutions (6). When immersed in aqueous solutions of organic dyes, reactions take place with the oxide coating that result in the formation of an insoluble lake which is precipitated throughout the coating (4). Such treatment provides deep and beautiful shades especially appropriate for decorative effects on household items, plastic inlays, cigaret cases, pen and pencil parts, compacts, and the like.

Since colors thus formed, like those in textiles, are prone to fade on continued exposure to weather and sunlight, methods have been developed to provide a high degree of permanence through the use of inorganic materials. Thus, for more severe, outdoor service, mineral pigments may be absorbed in the aluminum coating. Not as bright as dye colors, such treatments do possess a greater light-fastness (3). These oxide films provide ideal bases for paints (7).

Several processes are in commercial use for producing protective oxide films on aluminum and its alloys by anodic treatment. It is generally agreed, however, that, among the many solutions for producing the oxide finish, those based upon sulfuric acid, chromic acid, and oxalic acid are the most important (2, 4, 8). Glycerine is extensively used in the methods based upon the use of such materials, as well as many others.

Anodic treatments based upon sulfuric acid baths are probably the most extensively employed. Such methods produce coatings most suitable for coloring, since the film formed is practically colorless, transparent, and hard. In addition to being quite economical and rapid, the process is performed with inexpensive equipment. According to Young (2, 4), aluminum is made the anode in a solution containing 100 to 1,500 gm. of sulfuric acid (specific gravity 1.84) per liter. An inhibitor like glycerine, approximately 2 gm. per liter, is added to prevent excessive etching and help provide a smooth, white surface. The current density varies from 15 to 25 amperes per square foot for 15 to 20 minutes with the solution temperature between 65 to 95 deg. F. After a suitable period of treatment, the material is removed from the electrolytic solution and rinsed in clear water.

Most of the better known, standard anodizing processes based upon sulfuric acid employ glycerine as the inhibiting or retarding agent. Thus, the "Alumilite" process provides for the addition of ammonium sulfate and retarders, such as glycerine, to 15 to 20 per cent or 60 to 70 per cent sulfuric acid. The Tennents method provides for the addition of 15 per cent by volume of glycerine to 65 per cent by volume of sulfuric acid. "Anotint" utilizes 33 per cent sulfuric plus glycerine, carbohydrates, or metals (8).

Other patented anodizing processes employing this acid have similarly called glycerine into use. One such (9), patented well over a decade ago, made use of a bath containing 60 to 77 per cent of sulfuric acid plus glycerine as a retarding agent. Methods were given also whereby the protective layer on the aluminum could be colored by precipitation of a pigment in the pores of the layer by a chemical reaction.

The chromic acid bath is used chief-

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ly for anodizing aluminum against corrosion in as much as the finish produced is usually softer than that obtained with sulfuric acid electrolytes. Since coatings resulting from the chromic acid process have a slight grayish tinge and are somewhat opaque, the process is not extensively used for coloring aluminum and its alloys (2). A particular patent (10) serves to illustrate the use of glycerine in the chromic acid process of anodizing. In this case, the electrolyte is composed of from 3.5 to 7 per cent by weight of chromic acid, 1 to 3 per cent of glycerine and an aldehyde, such as formaldehyde, together with boric acid in a proportion of 0.3 to 0.5 per cent. It is also preferable to include soluble chromates in quantities not exceeding 2 per cent.

The patent literature offers many other examples of aluminum anodizing treatments in which glycerine is specified as an important component of the electrolytes. In certain patented methods (11, 12) for forming anodic coatings on aluminum or alloys, the articles to be coated are suspended in a still electrolyte bath containing sulfuric acid, aluminum sulfate, oxalic acid, glycerine, and copper sulfate. If desired, boric acid may be substituted for the copper sulfate. With this solution, an anodic layer is deposited at 4 to 40 volts (optimum 6 volts), a relatively thick deposit being formed in thirty to forty minutes.

Other acids may be used for treating aluminum, and glycerine is often employed in conjunction to provide its own desirable effects. Illustrative is the use of the following electrolyte to produce anodically an opaque protective coating on aluminum or its alloys:

Ammonium thallium oxalate	12.0 gm.
Citric acid	15.0 gm.
Borax	15.0 gm.
Glycerine	20.0 gm.
Water	8.0 liters

This is used at 68 deg. C. at 120 volts with an initial current density of 3.5 amperes per square decimeter and continued until the current density drops one-half. According to the patent (13), salts of zirconium may be used in place of the thallium compound and other organic or inorganic acids may be employed. A variety of methods for coloring the coating are provided in the specifications, such as processes for making them water-repellent and for coating with varnishes or resins.

Rather interesting is the suggested (14) use of glycerine as the vehicle for making non-aqueous electrolytes for forming an oxide layer on aluminum by anodic treatment. The non-aqueous bath comprises a solution of boric acid or of an organic acid (like citric, tartaric, or lactic acid) in glycerine, the bath also containing an ammonium compound such as ammonium carbonate. The bath is maintained at 120 to 140 deg. C., and the current density is such that the anode attains a temperature of about 200 deg. Centigrade.

It should be noted that the value of glycerine is not limited to use with acids, whether organic or inorganic. Caustic soda, for example, has also been employed for coating aluminum by anodic treatment. According to one process described in a British patent (15), the following solution may be used as the electrolyte:

Sodium hydroxide (98%)	20.0 gm.
Glycerine	150.0 c.c.
Water	1.0 liter

A few other materials may be used to replace the glycerine, including a mixture of 125 c.c. glycerine and 20 c.c. of a formaldehyde solution. The baths are operated at 10 to 15 volts, with a current density of 18 to 24 amperes per square foot at 15 to 25 deg. Centigrade.

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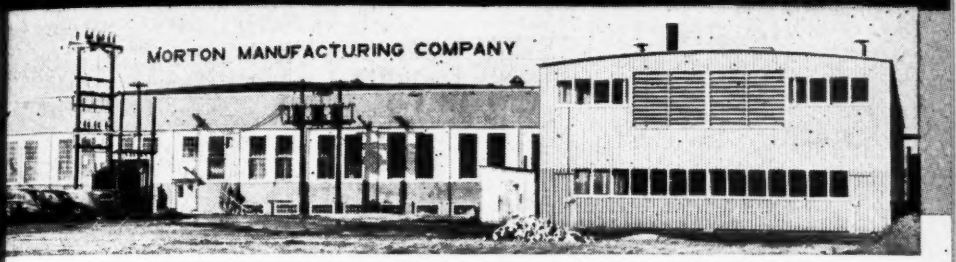

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The use of glycerine in a solution containing sodium aluminate also is worth noting. According to the patent claims (16), a colorless, hard, adherent, absorptive coating is produced on aluminum by immersing the metal for from ten to thirty minutes at 70 to 100 deg. C. in a 1 to 2 per cent aqueous sodium aluminate solution containing varying proportions of glycerine as a stabilizer.

In view of the growing utilization of glycerine in baths for the electrolytic polishing of metals, it is noteworthy that this fluid may show similar potentialities with respect to aluminum. This is indicated in the discussion of Mathers and Ricks (17) on anode polishing. Here it was reported that aluminum was successfully polished in a bath containing 12 c.c. of concentrated sulfuric acid and 24 c.c. of glycerine electrolyzed at 0.25 ampere for twenty minutes. The presence of water and hydrochloric acid was found to cause etching.

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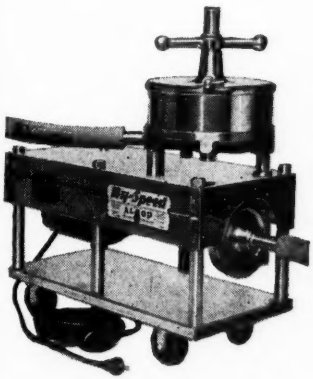

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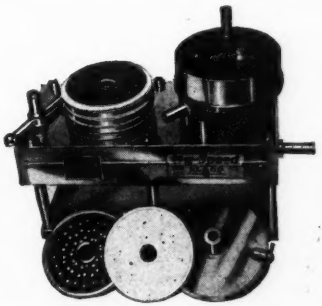

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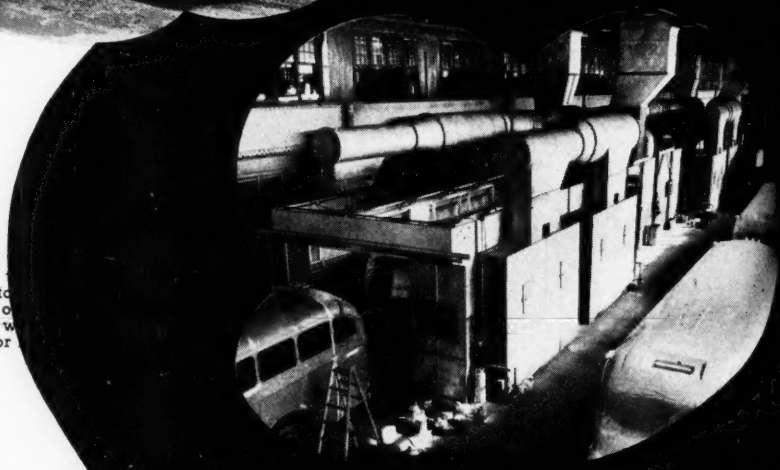

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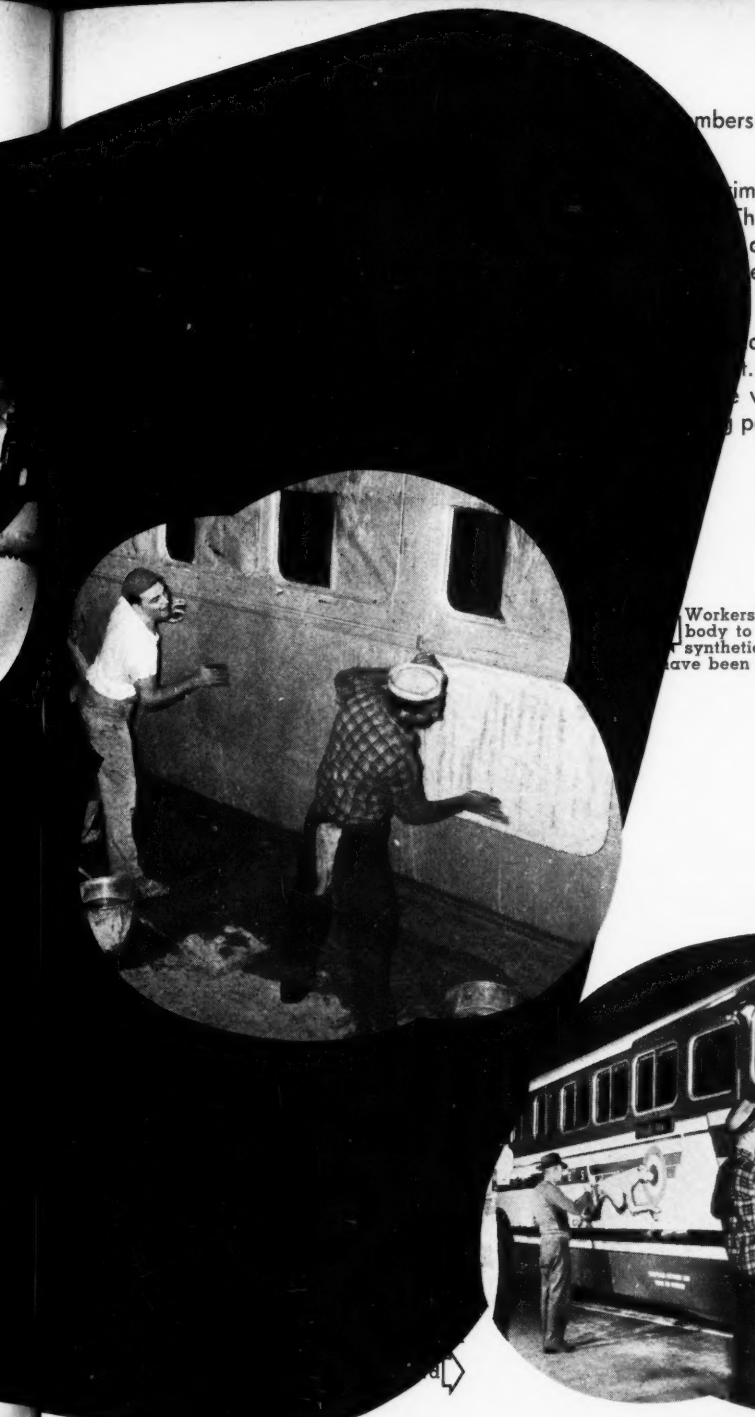


Workers water sanding a bus body to which three coats of synthetic baking surfacer have been applied

Finishing Clinic

Scientific Evaluation of Metal Cleaners

By DR. ALLEN G. GRAY

•

A Monthly Digest on Current Technical Progress Indicating Significant Trends and Developments in the Finishing Industry

•

FROM the standpoint of the coating operator, the cleaning of the base metal prior to coating is one of the most important steps in the total process. It is a well recognized fact that the quality of coatings and of finished coated products depends, to a great extent, on the cleanliness of the base to which the coatings are applied. The coating operator is interested not only in producing a quality product, but more important he should also be interested in making the most efficient use of the coating material. Each type of coating material has fairly definite properties so that for any standard unit of thickness a rather definite amount of protection may be expected. It follows then that if the coating operator is to make the most efficient use of the coating material, certain requirements must be met so far as cleaning of the base metal is concerned.

Just what degree of cleaning does the coating operator need? This is a somewhat difficult question to answer due to the fact that the property of removing oil from metals is rather easy to recognize and evaluate qualitatively, but somewhat more difficult to evaluate quantitatively. Practically any alkali cleans most of the oil from the metal and, unless a quantitative evaluation of the residual oil can be made, the true value of a metal cleaner is left as a matter for conjecture.

The "water-break" method has been used for a long time as a criterion for evaluating metal surface cleanliness. In general, it has not been found to be an adequate estimate of the efficiency of metal cleaners, since the water-break

THIS MONTH . . . Scientific Evaluation of Metal Cleaners . . . Corrosion Resistance of Lead and Lead-Tin Deposits on Steel . . . Importance of Metal Temperatures in Baking of Finishes . . . Requirements for Salt Spray Testing . . . Refinishing Procedures for Magnesium.

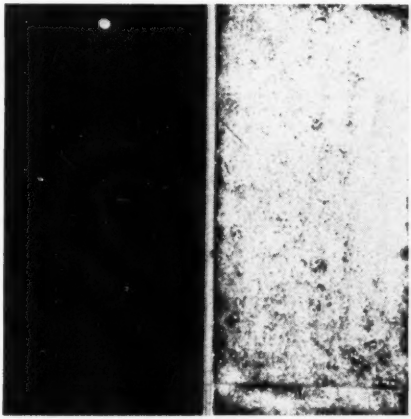
pattern is dependent on the thickness of the water film, and the evaporation rate is also a factor in obscuring the results.

One method of evaluating metal cleaners is based on photographing fluorescent oil residues under ultraviolet light after a standard cleaning procedure has been used ("Ind. Eng. Chem.," Anal. Ed., 14, 1942). In general, the measurement of one or several physical or chemical characteristics of an alkaline cleaning solution is not sufficient to establish quantitatively its merit as a cleaning agent. Indications are that a performance test involving the cleaning of uniformly soiled metal samples and the observation of the residual traces of oil appears to be one of the best methods of studying metal cleaners.

Mineral oil fluoresces brightly under ultraviolet light. Animal and vegetable oils which do not fluoresce in their own right can be made to fluoresce by the addition of an oil soluble fluorescent dyestuff. Since this white fluorescence of the various oils is proportional to the amount of oil adhering to the metal surface and since clean metal appears black under ultraviolet light, a natural scale of measurement is established for evaluating the efficiency of a metal cleaning compound. The fluorescence is capable of being photographed, thereby providing a permanent record of the cleaning ability. By the use of this method, it is reported that fine distinctions can be made between cleaning compounds.

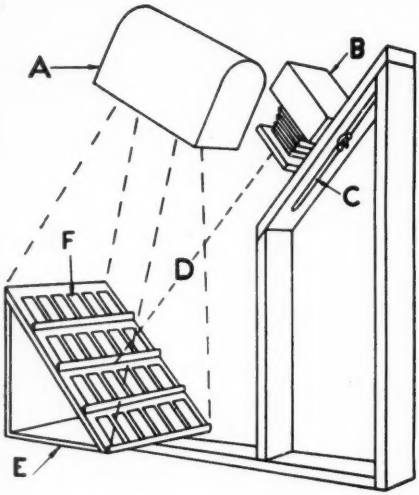
Recently, a new method for evaluating metal cleaners which was developed at Frankford Arsenal has been described ("Ind. Eng. Chem.," Anal. Ed., March 1946). This method, which is reported to be fairly simple and capable of giving results of good reproducibility, involves the coating of metal panels with various oils by specific dipping and drainage technique, followed by a carefully controlled cleaning and rinsing procedure. The panels are then covered with a fine spray of water, which condenses as droplets on the oil-covered areas, providing a pattern that remains constant for a sufficient time for a sketch to be drawn on paper divided into 100 squares. In this work, reported from the Arsenal, the average value for cleaned area of 5 panels was designated as the cleaning efficiency index for a particular cleaner.

Some of the modifications desirable for application of the method developed at Frankford Arsenal to specific plant problems are obvious. The plant coating operator will probably want to adapt the procedure to study of removal of specific oil contaminants on the particular product with which he is working. Panels of light gauge metal 4 inches square of cold-rolled S.A.E. 1010 steel were used in the work at the Arsenal. Cold rolled brass or aluminum may also be used. Two oils were used for coating test panels —one a hydraulic mineral oil of high viscosity and the other a sulfurized lard oil. The panels were placed in the



Luminogram of steel with mineral oil. (Left) Clean steel, no oil. (Right) Oiled steel, 113 x 10^{-6} gr./sq. in.

cleaner so that at least 1 inch of the solution was above the top of the panel in order to reduce the effect of temperature changes near the surface. Following the cleaning cycle, the panel was withdrawn and placed in a tank of running water maintained at 50 deg. C. It was withdrawn from the water once each minute during a rinsing period of 5 minutes. The panel was then rinsed in water at room temperature for 1 minute and allowed to drain for 1 minute.



Photographic arrangement for taking luminograms: (A) ultraviolet lamp, (B) 4 x 5 view camera with K-2 filter and Tri-X film, (C) slot for camera adjustment, (D) distance from camera lens to easel, approximately 36 inches, (E) easel, and (F) metal strips, 2 x 4 inches

In the procedure for **quantitative evaluation** of the cleaning efficiency attained in the test, a fine spray of water is directed at the panel from a distance of approximately 2 feet by means of an atomizer connected to a compressed air line. The oil covered regions are delineated by the condensation upon them of fine droplets of water, resulting in a pattern which remains constant for at least 20 minutes. These are then sketched on paper ruled into 100 squares, a typical diagram being shown herewith. The number of squares covered with water (no droplets condensed) is counted for each side of the panel. The results obtained with 5 panels, resulting in 10 observations, are averaged and this is designated as the cleaning efficiency index.

The first step in using any method for evaluation of metal cleaners is to select the type and grade of oil that is to be used in determining the oil removing properties of the cleaner. Obviously, the oil must be as hard to remove as any that will be encountered in production. The coating operator should find these methods of testing valuable in order to eliminate the necessity of using production lines to find the right cleaner.

* * *

Corrosion Resistance of Lead and Lead-Tin Deposits on Steel

SOME of the factors affecting the corrosion protection of steel by lead and lead-tin alloy electroplates were discussed by A. H. Du Rose of The Harshaw Chemical Company, Cleveland, at the 89th Convention of The Electrochemical Society held at Birmingham, Alabama, on April 11-13. The rapid increase in the use of lead deposits for corrosion protection brought about by the curtailment of the use of certain strategic metals during the war has accelerated investigation by the plating industry.

Based on the results of more than 2 years of outdoor and salt-spray exposure tests on lead and lead-tin alloy deposits, Mr. Du Rose stated that these electroplates could definitely be considered a good coating for protection of steel. While lead deposits do not afford the absolute electrochemical protection given by zinc and cadmium, it appears to be much better

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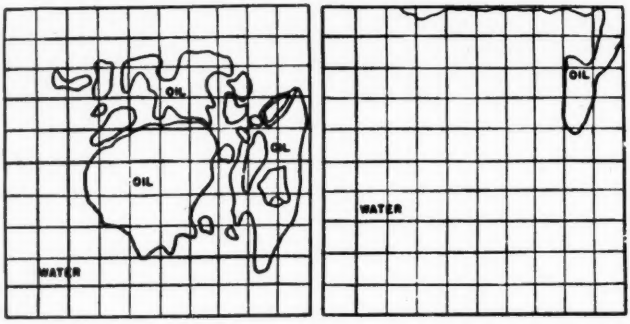

Cleaning results obtained using the water spray method. (Left) Cleaning index 73 (fair). (Right) Cleaning index 94 (good)

tested for the fluoborate bath, affording better covering and throwing power. The glue concentration was also shown to be an important factor in the corrosion protection afforded by the deposits to steel, particularly as shown by salt spray tests.

According to the corrosion tests carried out, a lead-tin alloy deposit containing 5 to 6 per cent tin exhibited corrosion protection superior to that of pure lead or to alloys of higher tin content. The lead-tin alloy deposit appears light initially and remains more uniform in color after outdoor exposure than does pure lead.

than would be thought from its position in the electromotive series. According to Mr. Du Rose, some of the corrosion data collected indicated that lead deposits and particularly lead-tin deposits provide as good protection as zinc. However, due to the poor throwing power of the lead bath as compared with cyanide zinc, areas receiving low current densities in lead plating could not compete with zinc in corrosion protection. The use of a copper flash prior to the lead deposits has been found advantageous in some cases. In general, Mr. Du Rose showed that a copper flash (0.00005 inch) improves the corrosion resistance of lead plated steel if the lead has a thickness of 0.0001 to 0.0005 inch. In some cases, a copper flash under a 0.00005-inch deposit of lead has been detrimental, and, if the lead deposit is heavier than 0.0005 inch, the benefit derived from the copper flash is questionable.

The data presented by Mr. Du Rose were based on deposits produced at room temperature using a 40-deg. Bé. lead fluoborate solution containing approximately 218 g./l. (29 oz./gal.) of lead. Lead plating solutions without addition agents have a tendency to produce treed deposits on high current density points. Mr. Du Rose brought out the fact that from the practical standpoint glue was found to be as suitable as any addition agent

* * *

Importance of Metal Temperatures in Baking of Finishes

IN all baking of finishes on metal parts, the finishing engineer should remember that it is the metal temperature and not the oven air temperature which is the governing factor. This applies equally to both radiant and convection ovens. The entire mass of the metal being baked must be brought to the required baking temperature to provide satisfactory results on the finished article. The rate of metal temperature rise varies greatly with the thickness or weight of metal. A baking schedule determined for light metal would not be satisfactory for heavier gauge metal. This fact is extremely important and becomes of greater signifi-

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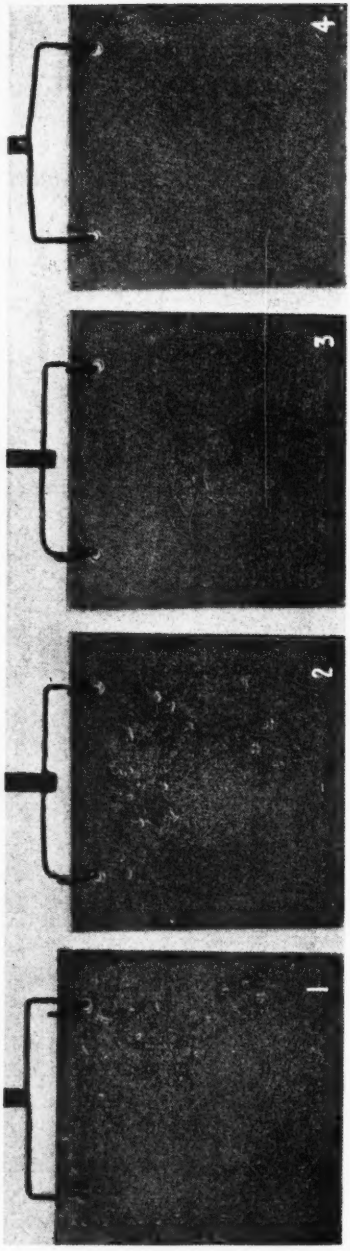

Test panels obtained using the water spray method. (1) Poor cleaning (cleaning index 6). (2) Fair cleaning (cleaning index 73). (3) Fair to good cleaning (cleaning index 88). (4) Good cleaning (cleaning index 94)

cance as shorter baking schedules are considered.

This discussion illustrates a factor too often overlooked that cannot be stressed too much. An underbaked film often feels dry to the uninitiated and may even approach the desired hardness. In physical property tests, however, these underbaked films will fail miserably and will be totally inadequate as compared with films of the same finish properly baked. This will be manifested by poor humidity and grease resistance in the case of a refrigerator finish or by poor soap resistance in a washing machine finish. It is, therefore, quite important to make metal temperature determinations by the use of thermocouple readings where metals of varying weights are involved. The shorter the baking schedule, the greater the need for this precaution.

The successful use of short baking schedules requires the most careful standardization of operations in the choice of metal weights and timing in the oven to avoid under and over-baking. It is because of this that the use of baking schedules of from 30 to 45 minutes are more foolproof and provide greater flexibility in the operation. In certain industries, however, where uniform thin gauge metal is coated, short baking schedules can be used without encountering the difficulties previously mentioned. Examples of such uses are coatings for metal Venetian blinds and coatings for tinplate by the can manufacturer.

* * *

Requirements for Salt Spray Testing

A.S.T.M. B 117-44T is an excellent and complete specification for salt spray testing, but it appears that more specific instructions are needed for reproducible results.

The 0.50 cal. Metallic Belt Link Committee of the U. S. Ordnance Department has established seven essen-

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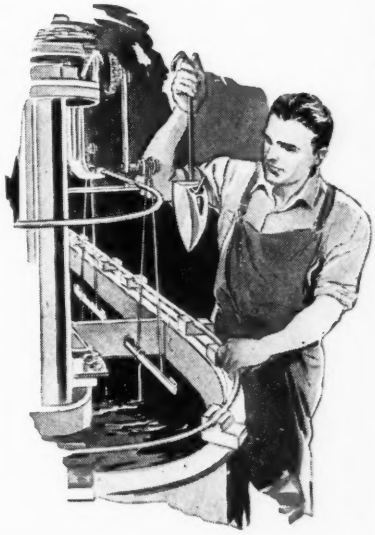

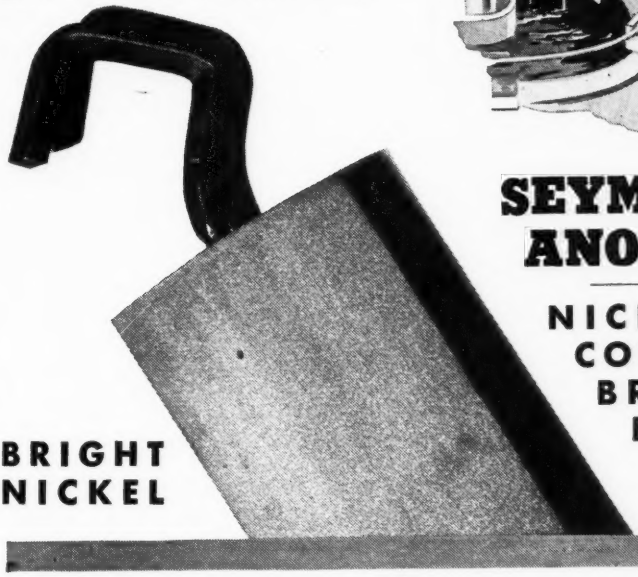

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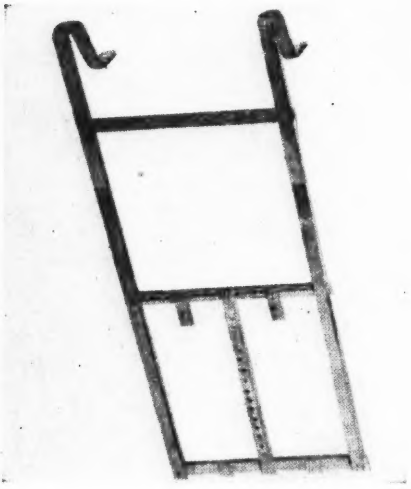
tial requirements for salt spray testing: (1) compressed air entering the box must have 84 to 90 per cent relative humidity; (2) temperature inside the box must be 92 to 97 deg. F.; (3) atomization must be such as to provide ½ to 3 c.c. per hour of fog; (4) collected fog must contain 18 to 22 per cent salt; (5) pH of the salt solution in the reservoir must be 6.5 to 7.2; (6) specific gravity of the salt solution at 95 deg. F. must be 1.126 to



Plating rack used for lead and lead-tin test panels

1.157; and (7) box and humidifier materials must be completely resistant to the salt solution.

Concerning the last point, Monel, hot tin dipped copper, and rubber-lined materials have proved satisfactory for the saturator tank. Copper, or a combination of copper, rubber and Monel, may be used for the pipe line. Fixed Monel nozzles are recommended. The suction pipe from the salt solution to the nozzle should be hard rubber. All equipment inside the box should be Monel or hard rubber. It is recommended that the salt spray box be heated by a hot water jacket. An air pressure of 14 to 15 p.s.i. is best as higher or lower pressures increase the corrosion rate.

The salt solution should consist of 20-2 parts by weight sodium chloride in 80 parts by weight distilled water. City water may also be used if the total solid content is under 200 p.p.m. The sodium chloride should contain under 0.1 per cent sodium iodide and under 0.2 per cent total impurities. The solution should be filtered before it is placed in the reservoir ("The Monthly Review," Vol. 32, 1945).

* * *

Refinishing Procedures for Magnesium

THE choice of technique for refinishing magnesium parts and structures will be governed to a large extent by the size of the article to be refinished. If parts are small enough, they can be immersed in a paint stripping bath, chemically treated, and repainted with the original system.

However, if the structure is too large to be immersed, and if the old finish is exhibiting good adhesion, complete removal is neither necessary nor advisable. The old finish needs only to be sanded, care being taken that the finish is not sanded through to the underlying metal. Any loose paint should be removed and the metal underneath sanded until bright. If the general condition of the old paint job is poor enough to make complete removal advisable, a good quality paint and varnish remover of the waxless, solvent type may be used. Burning-off of the old surface is not recommended. Sandblasting may be used on castings and heavy sections but should be used with care on thin sheets to avoid distortion. The following solution, developed by The Dow Chemical Company, is recommended for application by the "brush-on" method to all

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Concentrated Nitric Acid (Sp. Gr. 1.42)----------1.5 pints

Water ----------to make 1.0 gallon

The solution should be freshly prepared and, when brushed on, allowed to remain for about one-half minute, following which it should be thoroughly washed off with running water. Hot water, hot air, or other similar method of promoting drying is recommended. When treating riveted or bolted assemblies, care should be taken to avoid entrapment of the solution in the joints. The structure should be repainted as soon as thoroughly dry. In general, the repainting procedure can be much the same as the system originally used.

New Silver Polishing Process

THE accidental use of a silver plated wire in cleaning phosphor bronze electrolytically has given birth to a new polishing process for the silver industry. Credit for developing the novel electroplating method goes to Dennis R. Turner, youthful physicist in the electronics department of the research laboratories of the Westinghouse Electric Corporation.

With the new method, the silver plated object is immersed in a bath of silver cyanide solution normal to the regular plating operation. However, instead of passing negative current through the bath as in plating, positive current is applied in about four times the amperage used to plate the metal, but not continuously. The positive energy is applied for a few seconds, discontinued, and then passed through the bath again. This intermittent action is repeated for several cycles. When the article has reached its peak of luster, it is removed from the bath, rinsed, and dried. The entire operation is said to take little more than a minute.

In order that the current is applied and interrupted at the proper and regular intervals, a small motor is connected with a switch that opens and closes a contactor to send along the intermittent flow of energy. The electropolishing method is now being used in Westinghouse research laboratories to polish silver contactors, items of switchgear, microwave apparatus, radar sets, and other devices needed in experimental work.

Oakite Composition No. 92. A service report describing Oakite Composition No. 92—a heavy-duty alkaline-type detergent developed for use in connection with steam cleaning—has been prepared by Oakite Products, Inc., 40 Thames St., New York 6, N. Y. Copy free.

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(Courtesy The Bettmann Archive, N. Y.)

Metal Plating in Pre-Columbian America

By EUGENE W. NELSON

THE flint arrow head has become so much a symbol of the American Indian that it is somewhat difficult to realize that he ever achieved anything in the field of metallurgy. Yet it is a fact—proved by years of painstaking field work and research into ancient documents—that as metallurgists, the aboriginal inhabitants of North and South America deserve high rank among the primitive peoples of the world.

Reconstruction of a true picture of the metal industry in Pre-Columbian America has been difficult for two reasons. First, the Spanish Conquistadores effectively stamped out the two greatest existing civilizations—the Aztec and the Peruvian—and therewith all the arts and sciences of those people. Second, Spanish religious workers demolished all but a handful of the writings of the Aztecs and Mayans which may have contained information concerning the attainments of these Mexican and Central American natives in metalworking. Despite such handicaps, however, a fairly complete knowledge has finally been arrived at concerning the metal-working techniques used by the Red Men, through the efforts—over a period of more than half a century—of field archaeologists and museum experts.

The metals generally known before the advent of the Europeans were copper, gold, silver, tin, lead, and platinum. The last named metal is interesting inasmuch as Europeans had never encountered it. The Indians of

Fig. 1—(Above) Drawing showing the interior of an ancient Roman copper mine in Spain. The primitive ladders are cut out of tree logs. These ladders are much the same type as those used by the Great Lakes Indians in the deeper copper mines on Isle Royal.

northern South America obtained platinum in a manner yet unknown; alloyed the metal with gold and copper to form an alloy known as "tumbaga"; and from this metal made rust-resistant fish hooks.

In addition, the Great Lakes Indians carried on extensive copper mining activities on Isle Royal; the Aztecs mined gold in the Valley of Mexico; and the Peruvians (often wrongly called the "Incas") had extensive workings in the Potosi region of Bolivia from which they took copper and tin. Both Aztecs and Peruvians had learned something of the science of smelting ores and were proficient at melting and casting metal in molds. The Peruvians had even learned to make a hard bronze using 10 per cent tin and forged the alloy into beautiful axe heads of cenventional design.

There is another phase of metallurgy in which the aboriginal Americans developed a unique degree of skill—the overlaying of one metal with another, or plating. Electroplating, of course, was not employed but effective results were obtained in spite of such an obvious handicap.

Among the tribes inhabiting what is now the United States, the overlaying of objects with thin sheets of copper, gold, silver, and even meteoric iron was practiced extensively. Most of the copper used was mined on Isle Royal in Lake Superior by a method so crude and laborious that after investigating it more closely, one is tempted to revise his opinion of the traditional "lazy Red Skin."

Mines as we know them with shafts, elevators, explosives, and high speed drills were totally non-existent. To the Indians, a copper mine was a shallow trench dug into the side of a hill. The trenches were seldom more than 25 feet deep and from 200 to 300 feet long. But remember—they were dug with bare hands, sometimes aided with canoe paddles. Crude ladders made by lopping branches off trees were used in the deeper mines. Fig. 1 although actually an illustration of an ancient Roman copper mine in Spain, affords some idea of what these Indian ladders were like.

When a streak of copper was discovered, a fire was kindled beneath it. After the rock was well heated, water, carried to the spot in wooden bowls, was thrown on the heated portion. The expansion and contraction weakened the rock and this portion of the wall was pounded with stone mauls—held in the bare hands— to complete the removal of the copper nuggets.

The metal was worked by hammering on a stone anvil with stone ham-

Fig. 2—Reproduction of an Azetc drawing which appears in a book of Aztec picture writing, now called "The Codex Florentino." The drawing depicts an Aztec goldsmith melting gold over an open fire.

mers. There is some evidence to show that these Indians knew the trick of annealing or softening cold worked copper by heating it red hot and quenching in water. They did not, however, master the science of obtaining copper from its ore by smelting. All copper obtained by Indians in the United States was obtained by the method described, either in Isle Royal or in some other section where pure copper abounded.

When used for overlaying purposes, the copper was beaten out into extremely thin, uniform sheets and given a high polish with sand and water. The copper sheet was carefully fitted over the object to be "plated" and the edges turned under to hold the metal sheathing in place. In the United States Museum there are on display two figures of humming birds, carved from wood, the wings and tails of which are overlaid with copper in this manner. The wing pieces are so well made that they are in contact with the underlying wood at practically every point, even today.

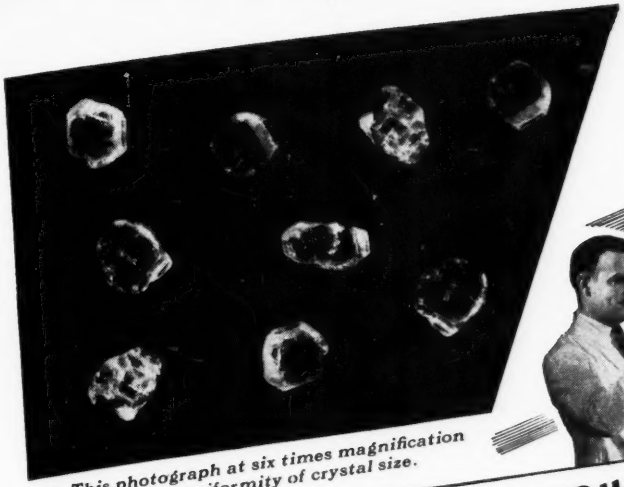
A pair of copper ear ornaments, overlaid with a thin sheet of pure silver which had been hammered into place, were taken from a Florida burial mound. From mounds in the Mississippi Valley have come copper beads wrapped in silver foil; a copper pendant sheathed in copper; ear plugs of copper covered with meteoric iron; and many other such examples of Pre-Columbian metal plating. Naturally, the covering of wooden articles with sheet copper was far more common than covering with gold, silver, or iron.

Among the more advanced metallurgists of the Aztecs and Peruvians, the converse held true. Gold and silver far outranked copper as a plating medium. Among these more progressive craftsmen, simple overlaying with sheet had been abandoned at sometime in the far-distant past for a process of fire gilding, or "amalgam plating" as it is sometimes called. What little knowledge we have of their methods for accomplishing this has been gained by working backward from a handful of known or guessed-at facts.

The Aztec and Peruvian metallurgists were extremely wary about handing down a pictorai record of their activities for posterity. The only pictures extant showing Indian metallurgists at work are contained in some of the books of Aztec picture writing, about fifteen of which escaped the general destruction of thousands such volumes at the hands of the Spaniards. In one such book—called "The Codex Florentino"—there is a rather crude representation of an Aztec goldsmith melting gold over an open fire (see Fig. 2). A master smith and his apprentice are shown in Fig. 3. This comes from an unknown book. The two smiths are melting gold in a crucible suspended over the fire on a clay tripod. The helper is increasing the fire's heat by blowing through a copper blowpipe and is stirring the melt at the same time.

More help comes from the chronicles of the Spanish invasion of the New World. Here are a few passages referring to metal plating as practiced among the Indians of that period. Acosta, who wrote mainly about the Indians living on the Isthmus of Darien, says, "And the copper was gilt by the use of the juice of a plant rubbed over it, then put into the fire, whence it took the gold color." Another historian—equally veracious—Oviedo y Valdez by name, telling of the natives of Central America, had this to say, "They know how to gild copper in a manner resembling gold of 23 karats, this color being imparted by certain herbs, which process has been kept a secret from us Spaniards." The last part of the statement is the most remarkable.

As the Spaniards were looking for



★ *This photograph at six times magnification shows uniformity of crystal size.*

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Fig. 3—Reproduction of a drawing appearing in an unknown Aztec book which depicts a master Aztec goldsmith watching his helper blow up a fire and stir the melting gold. Gold is contained in a crucible which is suspended on a clay tripod over the fire.

just such wonders as gold plating from the juice of plants, no doubt many of them believed such tales implicitly. Still another chronicler, Martinez Gracida, was more thorough and less credulous. According to Martinez, "Gilding seems to have been executed by the Indians with quicksilver. The formula was a portion of gold to a portion of quicksilver. The liquid was smeared on a piece of silver or copper and then placed in a fire to volatilize the quicksilver."

Some years ago, Dr. William C. Orchard of the staff of the Museum of the American Indian subjected this process to an exhaustive test. Basing his work on the knowledge that the Peruvians, at least, had abundant supplies of cinnabar, Dr. Orchard roasted some of the Peruvian ore and from its ashes obtained a fair amount of mercury. With gold dust and mercury he prepared an amalgam and applied it to a clean sheet of copper. He fired this but obtained no results.

Thinking that perhaps there was a grain of truth in the writings which refer to gilding with plant juice, Dr. Orchard then prepared a copper surface by etching it with a citric acid solution before applying the amalgam. Firing these sheets produced an excellent gold plate over the copper. Citric acid was chosen inasmuch as acid from citrus fruits was deemed to be one acid with which the Indians would have been familiar.

Since a number of artifacts in the Museum of the American Indian are heavily plated with gold and are similar in appearance to the specimens turned out by Dr. Orchard, and also since the Peruvians were excellent craftsmen and expert in many arts, there seems to be no reason to doubt but that the ancient Indian metallurgists employed this amalgam plating method.

There is a rather amusing (to us) commentary on the effectiveness of the Peruvian metal-plating industry contained in an account of the Conquest written by Pizarro's secretary, Pedro Sancho. According to the gentle Sancho, the golden objects "collected" by the soldiers (consisting mainly of vessels, religious statues, and so on) weighed originally somewhat in excess of 156,000 pounds. After they had been refined to pure gold, however, the weight had decreased to a mere 82,000 pounds, to Sancho's abiding wonder. This is certainly a testimonal to the size and efficiency of the plating industry in ancient Peru, since the Spanish soldiers had been under the impression that they had collected nothing but pure gold objects. No doubt the Spaniards did not appreciate the plating industry at that time.

Considering how plentiful gold and

Stop Corrosion in Zinc, Galvanizing!

1-Prepare metal for painting

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Plus: No alteration in appearance

Low Cost! Easy to Use!

Iridite #10 Protects:

Zinc plated strip or galvanized sheet . . .

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That's right! The new Iridite No. 10 does a double job for steel mills, at lower cost! It protects zinc or galvanizing against unsightly and costly corrosion during shipping and storage periods . . . and makes an ideal paint base when the metal reaches the final fabricator. What's more, there are no changes in the metal's appearance . . . from corrosion spots or the dip itself. For, Iridite No. 10 is uniquely colorless . . . even maintains the spangled appearance of galvanizing!

SIMPLE AS A-B-C: *Galvanize, Iridite, Rinse!*

It's inexpensive to use . . . simple to apply at the mill! After the metal has been galvanized or zinc plated, you merely immerse it in an Iridite No. 10 solution . . . manually or automatically . . . for only 3 to 60 seconds. No special equipment needed. Follow this with a cold rinse and dry the metal as is usually done. Iridite No. 10 *unites chemically* with the zinc or galvanizing . . . forms a transparent, corrosion-resistant surface that may be mechanically worked *without* flaking, chipping or peeling.

WRITE FOR INFORMATION!

For complete details on this new, low-cost way of protecting metals against corrosion during shipping or storage, contact any of our branch offices shown below . . . or write to our main office: Rheem Research Products, Inc., 507 Chemical Bldg., 4004 E. Monument Street, Baltimore 5, Md.

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silver were among the Peruvians and Aztecs, and also the fact that these metals were **not** used for money, it is interesting to investigate the "why" of such widespread plating. The aboriginal Indians apparently did not value the "precious" metals in the same way we do today. To them, gold and silver were simply the most beautiful materials they possessed from which to make things. So, they developed plating in order to stretch their supplies as far as possible. Judging from the fact that the few ancient Peruvian metal objects that were saved from the Spaniards have all proved to be basically copper or bronze heavily overlaid with gold or silver, this industry must have been both important and widespread among them.

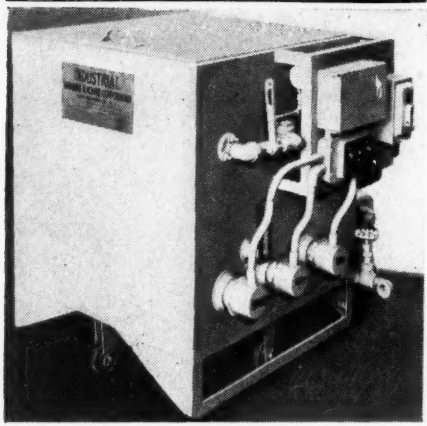
"Coated Abrasives in the Plastics Industry," a 20-page booklet on plastics from the "sanding" angle, is now being issued by the Behr-Manning Corp., Troy, N. Y. In addition to explaining completely abrasive selection, machinery and equipment, buffing, polishing, and so on, the entire first half of the booklet is devoted to an introduction and simplification of the plastics themselves. This introductory section clarifies much of the confusion resulting from the hundred of plastic names by combining similar materials into seven easily recognized family groups. Accompanying the booklet is a large 17 x 22-inch three-color chart enlarged from the center spread of the booklet and listing complete reference data on 70 of the popular rigid type plastics. Copy of booklet free upon request.

"Thermoil-Granodine," a phosphate coating which is designed to promote resistance to corrosion and wear, prevent scoring and galling, and provide a base for paint, is the subject of a four-page illustrated data sheet prepared by the American Chemical Paint Co., Ambler, Pa. Copy of Technical Service Data Sheet No. 7-11-101 free upon request.

THE NEW *Industrial* WASHING MACHINE

MODEL CBH

PORTABLE PARTS-WASHER AND DIP TANK



This is the midget of INDUSTRIAL'S wide range of metal cleaning and treating machines, but it is mighty in versatility and performance. Only 3'-6" x 2'-6", the new, compact, lightweight CBH cleans metals and parts thoroughly, converts to a dip tank in 10 seconds, protects operator's hands from detergents, is conveniently portable and handy to any part of your shop. The CBH is also the ideal washer to supplement your present cleaning equipment.

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Plating Barrels, Rheostats, Polishing Machines, Utility Blower Systems, Burring Machines on Benches with Dust Removal System. Complete line of Scratch Brushes, Buffs, Felt Wheels, Emery Wheels, Buffing Compounds, Plating and Polishing Supplies. All sizes, shapes. Pekay-Synthetic Rubber Wheels for fine emerying and deburring. Plastic Finishing Equipment and Supplies a specialty. Polishing Machines—all kinds, belt or motor driven.

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PESCO POLISHING MACHINES
Motor enclosed, from 1 to 10 H.P. Jeweler's Polishing Table Machines, Self-Contained Blowers (Ball-Bearing).

USED EQUIPMENT

Rectifiers—G.E., Green, Udylite, Federal—6 to 48V, 25-1500 amps., with controls.
Generators—Direct motor driven, self and outside exciter—6 to 48V, 100-6000 amps.
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WE CARRY LARGE STOCKS OF NEW and USED MACHINES and SUPPLIES—MOST ORDERS CAN BE SHIPPED WITHIN A WEEK.

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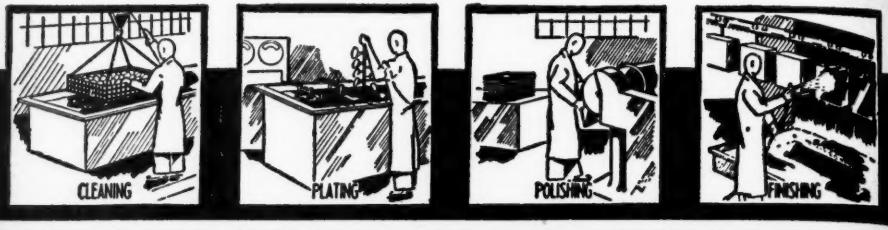
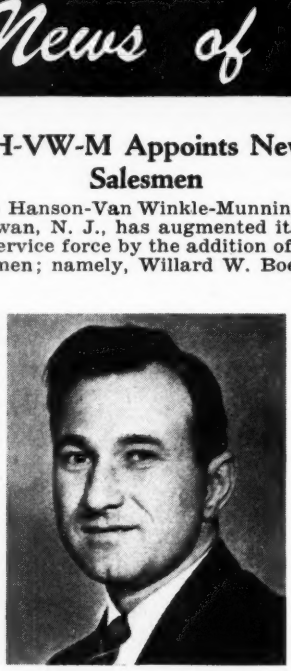


News of the Industry

H-VW-M Appoints New Salesmen

The Hanson-Van Winkle-Munning Co., Matawan, N. J., has augmented its field and service force by the addition of three new men; namely, Willard W. Boeswetter, Carroll A. Pickering, and Eugene B. Hauser.



Eugene B. Hauser

Mr. Boeswetter was graduated from the Milwaukee School of Engineering in 1940 with the degree of bachelor of science in electrical engineering. Prior to the war, he was engaged in the electrical manufacturing field, and from 1941 to 1943 was an instructor in the U. S. Army Air Forces.

Carroll A. Pickering was graduated from the University of Wisconsin with the degree of bachelor of science in chemistry and also took a specialized course in industrial engineering. Prior to the war, he was employed by Fairbanks, Morse & Company as an electrochemist. He was recently discharged from the United States Navy. Having completed a special training course at Matawan, Mr. Pickering is in the Chicago office as a field engineer.

Mr. Hauser was employed as a design engineer in the main office of the company from 1940 to May 1942. Thereafter, until April 1946, he served with the U. S. Navy with the rank of lieutenant. Following a special sales course at Matawan, he has been assigned to the New York City office of the company. Mr. Hauser is a graduate of Stevens Institute of Technology with the degree of mechanical engineer, having specialized in chemistry.

Pennsalt Names Manufacturing Manager

The appointment of Walker Penfield as manager of manufacturing of the Pennsylvania Salt Manufacturing Company is announced by Y. F. Hardcastle, vice president in charge of manufacturing. Mr. Penfield formerly was works manager, a position discontinued in a reorganization of Pennsalt's Manufacturing Department. He will assist and advise the vice president in charge of manufacturing on the improvement of manufacturing operations and fixing of manufacturing policies for all of the company's manufacturing operations ex-

cept those controlled by the Pennsylvania Salt Manufacturing Company of Washington.

Claude S. Beldin, regional superintendent, has been appointed to the newly created position of production manager. Mr. Beldin will be in charge of production control and will have overall supervision and responsibility for production, works storage, and preparation for shipment of all products except those produced by the Pennsylvania Salt Manufacturing Company of Washington.

Henry G. Meyer, formerly assistant to the works manager, has been named assistant to the production manager, and Russell E. Cushing, director of chemical engineering, now reports to W. F. Mitchell, superintendent of the Wyandotte, Michigan plant.

Mr. Penfield came to Pennsalt from the General Chemical Company in 1928. He started in Pennsalt's Development and Research Department, becoming manager of engineering in 1932 and works manager in 1943. Mr. Penfield is a graduate of Williams College with an A.B. degree in chemistry, and served in the U. S. Naval Reserve in World War I. He is a member of the American Institute of Chemical Engineers.

Mr. Beldin graduated with a B.S. degree in chemistry at Villanova College and joined Pennsalt in 1926. His first assignment was that of chemist in the Research and Development Department.

Appointed Regional Sales Manager

Laurence E. Anderson, former technical sales representative for Newport Industries, Inc., and National Lead Company, has been appointed regional sales manager of the newly formed West Coast region of Nuodex Products Company.

Mr. Anderson has had wide experience in both the technical and sales aspects of the paint field. His appointment reflects the increasing importance of West Coast paint operations and recognition by Nuodex of the need for a separate division of the company to service this expanding section.

A graduate in 1935 of North Dakota State College where he received his degree in chemistry and majored in paint and varnish technology, Mr. Anderson has devoted his business activities since leaving college to the paint industry. After graduation, he was for a time chief chemist of the Western Paint and Varnish Co., Duluth, Minn., and advanced to the positions of production superintendent and finally industrial sales manager. Mr. Anderson then joined the technical staff of the National Lead Company and covered ten middle western states out of the Cincinnati office. At Newport Industries, Inc., he was technical representative for the Mid-West territory.

Enlarges Public Relations Department

The Taber Instrument Corp., North Tonawanda, N. Y., precision equipment manufacturer, has enlarged its public relations department, according to an announcement by R. F. Taber, president. Formerly headed by L. S. Barker, vice president, the department is now being directed by Arthur P. Schulze, who has been appointed to the post of assistant to the vice president. Mr. Barker will concentrate on the company's sales management and development program. All of the company's industrial publication advertising, technical service information, and sales promotion activities will be handled by the enlarged department.

Arthur P. Schulze

Mr. Schulze assumes his duties as special relations director with nearly a decade of industrial advertising and publicity experience behind him. Recently discharged from the Army following 28 months of service in the Quartermaster Corps, Mr. Schulze formerly spent approximately six years in the specialized field of production and maintenance cleaning.

American-Marietta Plans Expanded Advertising Program

Prefacing the introduction of an expanded advertising program, W. O. Yocum, director of advertising for the American-Marietta Company, Chicago, Illinois, paint manufacturer, announces several changes in personnel and agency affiliations.

Harry L. Ault, advertising manager, Trade Sales Divisions, also assumes the sales promotion responsibilities for the newly created retail store division. Robert A. Ornberg is advertising manager in charge of Industrial Divisions. Bob Waidler, production manager, formerly editor of the "Masonic Chronicler" and photographic reporter for national magazines, heads the newly formed Public Relations Department.

Phillips-Reick-Fardon Advertising of Chicago and Kansas City has been appointed as the national agency in placing all advertising space and radio time. Simon & Smith, Portland, Oregon, are retained to service the company's three west coast divisions.

A comprehensive advertising program is planned on a national and regional basis for the United States and Canada, using campaigns in business papers, magazines, radio, billboards, and direct mail.

Clean Spray Booths

Spray BOOTHCOTE on clean booth.
Paint peels off in sheets.
NO SCRAPING—SAVE TIME and LABOR
Trial offer 5 gal. $5.50 F.O.B. Buffalo
Used by 2000 leading manufacturers.
MONEY BACK IF NOT PLEASED.
Write for Circular.
HYGRADE FOOD PRODUCTS CORP.
HARRIS SOAP—BOOTHCOTE DIV.
19 Stetson St., Buffalo 6, N. Y.

Changes in Sales Staff

A number of sales territorial changes and appointments are announced by the American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind. George C. Tolton has been appointed sales representative for the Northwestern states and will have his office in Seattle, Washington. Mr. Tolton has, for many years, been engaged in engineering and building naval defenses in the Seattle area.

Anthony Stimmler will represent the company in the new Minneapolis sales office. Mr. Stimmler has, for many years, been engaged in sales engineering for the mechanical division of General Mills.

Mitchell R. Christensen has been appointed sales representative in the newly created Denver territory and will have his headquarters in that city. A native of Denver and a well-known consulting engineer, Mr. Christensen has several patents and outstanding technical papers to his credit.

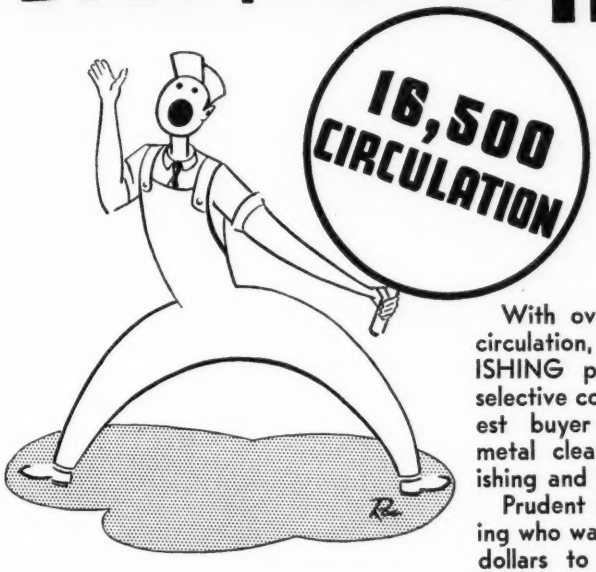
Hooker-Detrex Corporation

The Hooker-Detrex Corporation has been incorporated under the laws of the State of New York with a capitalization of 6,000 shares of preferred stock and 1,500 shares of common stock. The corporation is jointly owned by the Hooker Electrochemical Company whose main office is located at Niagara Falls, New York, and the Detrex Corporation whose main office is located in Detroit, Michigan.

The corporation has been formed for the purpose of manufacturing chlorinated solvents, the distribution and sales of which will be handled by the Detrex Corporation. The officers of the corporation include E. R. Bartlett, president; A. O. Thalacker, first vice-president; R. L. Murray, second vice-president, and G. E. Powers, treasurer. The board of directors is composed of these four officers in addition to R. A. Emmett and H. M. Hooker.

The site for manufacturing operations will be located in the Pacific Northwest where various materials are available and from which point distribution to West Coast markets will be handled.

STOP, LOOK, READ



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New Plant for Chromalox

The Edwin L. Wiegand Co., Pittsburgh, Pa., announces the construction of a new plant to expand facilities for the manufacture of Chromalox electric range units and electric heaters for industry. The new building, scheduled for completion by August 1, will add 45,000 square feet to present facilities and, with new equipment, will cost in excess of $300,000.

Rumford Chemical Appointments

Further additions to the administrative and research staffs of Rumford Chemical Works, Rumford, R. I., manufacturer of industrial chemicals, have been announced by Albert E. Marshall, president. Malcolm Farmer, Jr., New England representative of the Phoenix Iron Company prior to the war, has been appointed market analyst. Mr. Farmer will serve as the company's marketing representative with industry in the development of new chemical products.

Theophil Laanes, formerly a research assistant for the Carnegie Institution of Washington at its Department of Genetics, Cold Spring Harbor, N. Y., will be in charge of the literature research staff of the Rumford laboratory. Assisting Mr. Laanes will be Philip Leslie, M.A. formerly with the E. I. Du Pont Company, and Miss Edith Weiss, an Austrian refugee who was employed as an interpreter by the American Military Government in Italy during the latter part of the war.

George Deckey, an honor student in chemistry at Brown University, has been added to the research laboratory staff.

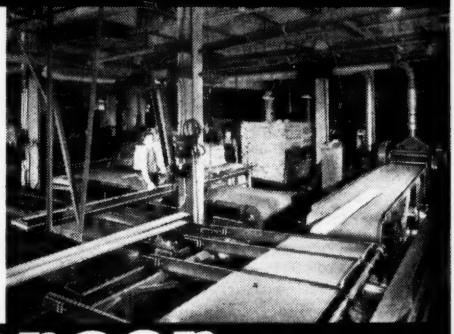
Hisey-Wolf 50th Anniversary

The Hisey-Wolf Machine Co., Cincinnati, Ohio, is now rounding out its first half century of service to the metal-working industry. Founded in 1896 to manufacture portable grinders, drills, and so on, the company is one of the oldest manufacturers of grinders, buffers, and polishers in the field and has pioneered in the development of many new methods and techniques for grinding and finishing metals to meet the ever-changing needs of the modern metal-working industry.

REMARKABLE *Manpower Savings* with JENSEN CONVEYOR SYSTEM

At Gunn Furniture Company, Grand Rapids, this Jensen-engineered-and-built conveyor system not only speeds production but also saves the daily cost of eight men. Here's how: Canvas belt conveyor, traveling 300 ft. per minute, carries board from planer . . . throws it onto metal shelf . . . board is then automatically transferred to five-strand conveyor, which passes it in front of series of cut-off saws . . . board then automatically drops onto second canvas belt conveyor . . . travels to opposite end of room for further operations.

Write Jensen about YOUR problem *today!*



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DESIGNERS and BUILDERS of "DUAL HEAT" INFRA-RED OVENS • STANDARD and SPECIAL CONVEYORS

For more than 10 years BUNATOL has been recognized as the leader in insulation for electro plating and anodizing racks and fixtures.

Here is a new BUNATOL No. 785, a rack insulation particularly adapted for insulating racks for decorative plating (Copper-Nickel-Chrome).

It's a heavy-body, free-dipping liquid that can be handled with less labor cost. Only one material and one tank needed. No. 785 does produce a superior rack insulation.

May we send you complete information?

NELSON J. QUINN COMPANY, TOLEDO 7, OHIO

BUNATOL

New Corporation in Full Production

Emerson DeJarnett, president of the newly formed Texo Corporation, Cincinnati, manufacturer of cleaning compounds, solvents, and lubricants, announces that Texo products will be available in principal cities by mid-July.

The Texo Corporation, a newcomer in the field, is, however, new in name only. Its officers, chemical engineers, and district supervisors are all men with 8 to 10 years of experience in product formulation and technical service work relative to metal degreasing and finishing operations.

Emerson DeJarnett

Texo engineers have developed an overall control plan whereby no shipment is permitted to leave the plant until the formula tolerance has been checked and a dated approval label has been affixed by the control laboratory. Thus, the user, it is claimed, is assured of uniformity of compounding, plus the knowledge that the material he is using is of recent issue.

Weismuller Appointed Assistant General Manager

Frederick H. Weismuller has been appointed assistant general manager of the Pigments Department of the Du Pont Company. He succeeds Crawford H. Greenewalt, who was recently made a vice president and member of the Executive Committee.

Director of sales for the Pigments Department since 1944, Mr. Weismuller attended public schools in Newark, N. J., and was graduated from Cooper Institute in New York City with the degree of bachelor of science. He joined Krebs Pigment and Chemical Company in 1926, this company becoming associated with Du Pont in 1929.

Mr. Weismuller was appointed superintendent of the Krebs plant at Newark, N. J., in 1932, and of the Edge Moor, Del., plant in 1934. He became assistant production manager of Krebs Pigments Department, now the Pigments Department, in 1935, and production manager in 1940.

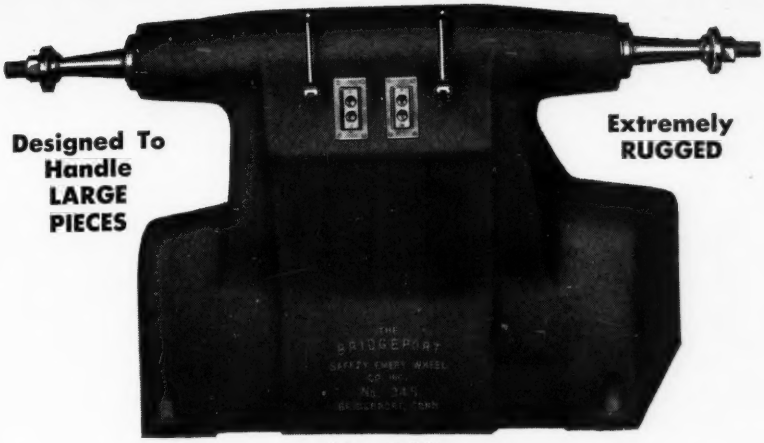
Rudolph Louis Suhl Passes

Rudolph Louis Suhl, manager of the Nickel Sales Department of the International Nickel Company at New York and an outstanding personality of the nickel industry and one of its pioneers, died June 10 in his 64th year. Mr. Suhl had been associated with International Nickel for over 43 years and at the time of his death was seventh in seniority of the U. S. Chapter of that company's Quarter Century Club. He joined the company's Oxford Works in Bayonne, New Jersey, on May 1, 1903, serving in the chemical laboratory and later became superintendent of the Calcining Department at that Works.

When the Development and Research Division of the International Nickel Company was formed in New York in 1922, Mr. Suhl was one of the original staff, bringing to that department his intimate knowledge of long experience with the processes involved in the production of nickel. After serving with this division for some years, Mr. Suhl became assistant manager of the Nickel Sales Department in 1929. He was made manager of the Nickel Sales Department in 1932.

During World War II, Mr. Suhl was a member of the Ferrous Alloys and Minerals Priority Committee of the Office of Production Management and as such was active in assisting that office and later the War Production Board in the wartime problems involving metals.

"Franzite," an air-dry synthetic suitable for one-coat application over steel or other non-porous surfaces, is completely covered in a revised bulletin issued by the Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn 6, N. Y. Copy of Bulletin No. 24 free upon request.



No. 345

"Bridgeport"

HEAVY DUTY BUFFING LATHE

FEATURES:

Two Heavy Carbon Steel Spindles of large diameter in bearings, tapered where wheels fit, driven by individual motors through multiple V-belts.

Spindles Overhung for extra foot room and easier swinging of unwieldly pieces.

Separate Hand Brakes and motor cut-out switch for each spindle.

Heavy Rugged Cast Iron Base for rigidity and smooth operation.

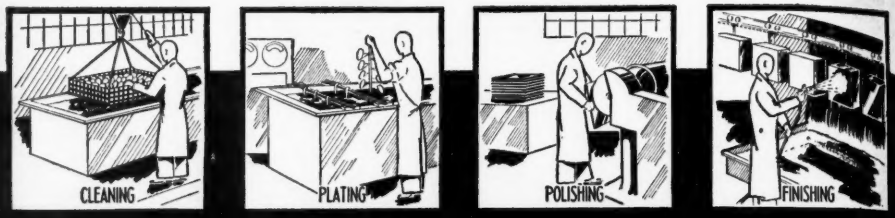
Modern streamline designing throughout.

Complete technical information on request.

THE BRIDGEPORT SAFETY EMERY WHEEL CO., INC., BRIDGEPORT, CONN., U. S. A.

Bridgeport

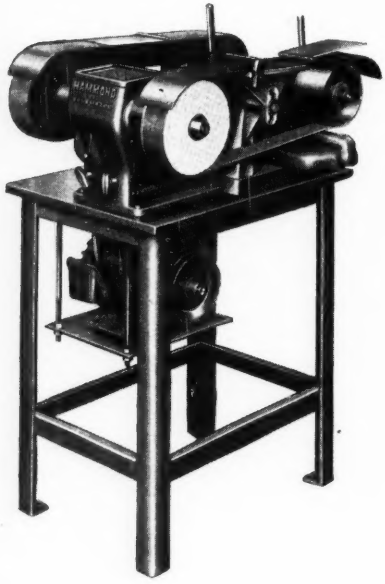
GRINDERS • GRINDING WHEELS • BUFFING LATHES



New Equipment and Materials

Hammond No. 5 Abrasive Belt Grinder-Polisher

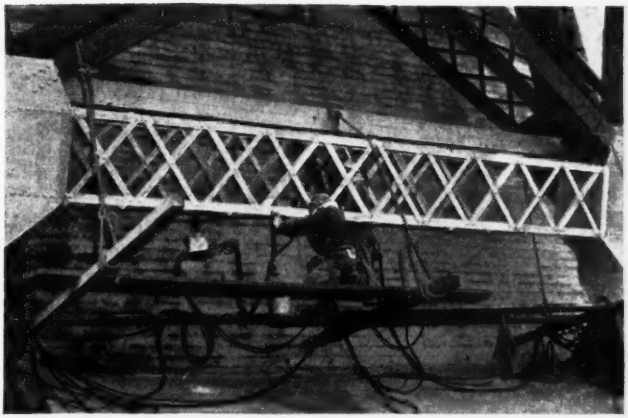
Designated as the No. 5, an abrasive belt grinder-polisher with horizontal platen for grinding, polishing, buffing, deburring, brushing, and many other similar operations is now being introduced by Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich. The unit is available with two backstands for accommodating abrasive belt 60 in. long and up to 3 in. wide.



Hammond No. 5 Abrasive Belt Grinder-Polisher

Offered in both bench and floor models, the Hammond No. 5 Abrasive Belt Grinder-Polisher consists of a frontstand with ball bearing spindle for contact wheels, and one right-hand and one left-hand backstand which are located on an extension of the frontstand. Handles for tracking the abrasive belts on the contact wheels and idler pullys are conveniently located on the lower front of the frontstand. An adjustable spring belt tension device and lever for quickly relieving belt tension when changing abrasive belts are incorporated in each backstand. Ball bearing idler pullys 6 inches in diameter x 3¼-inch face for abrasive belts up to 3 inches wide are standard equipment of the backstands, which are designed to accommodate contact wheels 8 inches in diameter and 60-inch long endless abrasive belts.

The base of the unit at bench measures 12½ inches wide x 25½ inches deep, and the distance from the bottom of the base to the center of the spindle is 8½ inches. The distance from center to center of the contact wheels is 16⅝ inches. Standard equipment of the bench type unit includes one 5F frontstand, one 5BR backstand, one 5BL backstand, spindle sheave, motor sheave, V-belt, toggle switch, and 60 x 2½-inch 80-grit abrasive belt. Standard equipment of the floor



Glaspray operator zinc coating a portion of the Golden Gate Bridge

model includes the above in addition to a floor stand and motor mounting. The bench model has a net weight of 130 lb., and floor model has a net weight of 200 pounds.

If desired, the Hammond Grinder-Polisher can be obtained with only one backstand, either right or left-hand.

Glaspray Process

A process for protecting bridges, ships, and other structures against the corrosive effects of constant salt spray, to be known as the Glaspray Process, is now being offered by The Glaspray Process Co., San Francisco, Calif. The process involves the application to the metal surfaces of a coating of zinc, lead, tin, aluminum, brass, bronze, copper, manganese, Monel metal, silicon, nickel, iron, chromium, glass, or plastics by means of a specially designed "gun."

The surfaces to which the coating is to be applied are first grit blasted so as to remove every particle of paint and rust, following which the protective material, in powdered form, is mixed with gas and forced by means of a "gun" through a flame of approximately 786 deg. F. to the clean metal surfaces, providing a protective coating whose thickness need not exceed 10/1000 inch to afford years of protection from corrosion, it is claimed.

An outstanding feature of the Glaspray Process is the flexibility of operation. The principal equipment utilized is the air compressing machinery which can be conveniently transported for long distances and quickly set up in a relatively small space. In the coating of tanks of naval vessels, the compressors can be located in pairs on the docks immediately alongside of the ships themselves. The grit and recovery tanks can be located on the decks of the ships, with lines of hose leading down into the tanks.

The Glaspray Process is said to be particularly effective in the application of plastic coatings to metals where acid corrosion is an important factor, such as in the petroleum, chemical, and food processing industries. Among the many advantages claimed for the process are that it results in the production of a surface of fine appearance, eliminates the danger of rust and corrosion for unusually long periods of time, and permits the use of inexpensive materials.

ACP Thermoil-Granodine

Thermoil - Granodine, a heavy iron manganese phosphate coating for steel which is said to retard rust and, when oiled, prevent excessive wear on friction surfaces, is now being marketed by the American Chemical Paint Co., Ambler, Pa. The coating is particularly recommended for use by manufacturers of pistons, piston rings, cam shafts, tappets, and so on.

According to the manufacturer, the oil-absorbing surface created by Thermoil-Granodine quickly burnishes and holds the lubricant, thus largely eliminating the dangers in the "breaking-in" period of high speed machinery. The product is claimed to provide an excellent finish for many hardware items and, when used under paint, is said to afford unusually high rust protection. Where a high luster is desired, Spray-Granodine is recommended since this material is said to produce a smoother surface.

Goodrich "Koroseal" Work and Acid Suit

The addition of a work and acid suit to its line of "Koroseal" industrial clothing is announced by The B. F. Goodrich

Goodrich "Koroseal" Work and Acid Suit

Co., Akron, Ohio. Made of high quality textile sheeting which is coated black with flexible plastic material (Koroseal), the suit is designed for maximum lightness and toughness, including resistance to abrasion and practically all solvents and acids.

Jackets and pants are furnished separately or as a unit. The jacket has a fly front with concealed ball and socket fasteners, strapped armholes and seams, and stand-up collar. The pants are of the bib type with adjustable shoulder straps in the back.

"Metclene"

"Metclene," a unique metal cleaner which is said to remove rust, grease, oil, and dirt in one operation, leaving a rust-resistant coating on the surface of the metal which is particularly receptive to paint, is now being marketed by Biofen Laboratories, 14 6th St., Bridegport 7, Conn. Paint applied to a surface cleaned with the material is said to adhere firmly, with the possibility of peeling eliminated.

Easy and safe to use, Metclene, according to the manufacturer, can be applied either in a manual or dip operation, with the former method being recommended where deep-seated rust is present. The material is a non-inflammable clear yellow liquid weighing approximately 9:5 lb. per gallon and with a pH of 2 to 3.

Pennsalt RI-50 Rust Preventing Agent

The Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pa., announces a rust preventing agent for use in water on ferrous metals prior to painting or enameling or between machine operations. Designated as Pennsalt RI-50, the product, which is packaged in 25, 100, and 300-lb. fiber-pak drums, is an inorganic salt mixture that is used in water solution to provide temporary rust protection on metal parts during processing.

The material is used as a water solution with a concentration of 2 to 4 per cent Pennsalt RI-50, and is designed for protecting metals for short periods such as after cleaning and prior to painting or enameling. It requires no rinsing before painting.

Mr. Electroplater—You have been searching for years for an additive that would harden and render your silverplate tarnish resistant, at a reasonable cost. HERE IT IS . . .

GRANIUM CYANIDE

Write for new booklet describing this and other products.

GRANIUM PRODUCTS

2616 DOWNEY ROAD LOS ANGELES 23, CALIFORNIA

"Chemical Engineers Since 1905"

TROXIDE

SOLVES DIFFICULT CLEANING AND PICKLING PROBLEMS FOR LARGE MANUFACTURING PLANT

Case No. 43:

A large Midwestern manufacturer of farm machinery, who had previously used sand-blast, tumbling, shot-blast and wire-brush methods for removing rust and scale, shifted to Troxide. Not only did Troxide do a quicker job, with less labor, but it also eliminated pitting or etching of smooth machined surfaces.

The same manufacturer then employed Troxide for the removal of heat-treat scale from axle shafts. This work was previously done by shot-tumbling, and was unsatisfactory because the heavy shafts tore the barrels apart in short order. Troxide proved satisfactory in every respect on this extremely heavy job.

• • • •

Troxide is the safe, modern chemical for pickling and bright-dipping. It eliminates the dangers of toxic fumes and acid burns. It removes rust and scale without materially attacking the good metal. As a pickling agent, it is easier to prepare, more effective, and longer-lasting than the conventional acid bath. All these advantages of Troxide make it less expensive to use than other materials and methods.

What is your pickling problem? Perhaps Troxide is the answer. Write Troxide across your letterhead or business card and mail.

TROXIDE

Suppliers:
South, Midwest and West: Waverly Petroleum Products Co., Drexel Bldg., Philadelphia 6, Pa.
East: Safety & Maintenance Co., Inc., 601 W. 26th St., New York 1, N. Y.

"Keepkan" Automatic Paint Brush Cleaner

An automatic paint brush cleaner to be known as the "Keepkan" is now being marketed by The Howe Co., Stony Creek, Conn. The complete unit consists of a patented brushanger, special laboratory developed liquid, and container for handling the entire brush-cleaning job.

As soon as the painting job is finished, the wet brush is simply inserted in the brushanger, which suspends the bristles in the liquid, thus allowing all of the pigment to be drained out of the brush. Even paint way up in the heel of the brush is said to be removed by capillary action. The brush is then soft and clean, ready for reuse or storage. Brushes used in different colors of paint may be cleaned at the same time and in the same can. Evaporation of the liquid is said to be negligible, and the liquid may be used over and over again.

"Keepkan" Automatic Paint Brush Cleaner

The Keepkan Automatic Paint Brush Cleaner is available in two sizes; namely, a household size which holds four brushes up to 3 inches wide, and an industrial size which holds five brushes up to 4 inches wide. Keepkan liquid refills to maintain the level in the container are available separately.

McKeon's
Zinc-Brite
TRADE MARK REG. U.S. PAT. OFF.
Purifies Plating Solution for Clean, Even-Plated Zinc!

- Simple, fool-proof in use. In liquid form . . . concentrated . . . just add water and sprinkle over plating solution.
- Purifies zinc plating solution on the heavy metal impurities. Throws down copper and other impurities in such fnely divided particles that they do not attach to the work.
- Less expensive than other materials. Its use has decided advantage as it cuts down amount of proprietary zinc brightener necessary.
- Saves time . . . never necessary to stop plating.

Sold on Approval— Unconditionally Guaranteed

Sulphur Products Co.
Greensburg 7, Pa.

"Griptred" Flooring and Covering Material

The production of "Griptred," a nonslip safety flooring and protective covering material for metal, wood, and concrete is announced by the Chemical Products Division of The Goodyear Tire and Rubber Co., Akron, Ohio. A combination abrasive aggregate and plastic binder, the material is said to be ideal for any surfaces where safety under foot is required.

Griptred is available in a choice of six colors and is designed to withstand crush loads in excess of 7,000 lb. per square inch. The material is applicable by trowel, spray gun, or brush.

To help increase "Take-Home Savings"

The Treasury Department has published two new booklets to help you and your employees realize the utmost benefit from your Payroll Savings Plan.

"Peacetime Payroll Savings Plan" for key executives offers helpful suggestions on the conduct of the Payroll Savings Plan.

"This Time It's For You" is for distribution to employees. It explains graphically how this convenient, easy thrift habit works. It suggests goals to save for and how much to set aside regularly in order to attain their objectives.

If you have not received these two booklets, or desire additional quantities, communicate with your State Director of the Treasury Department's Savings Bond Division.

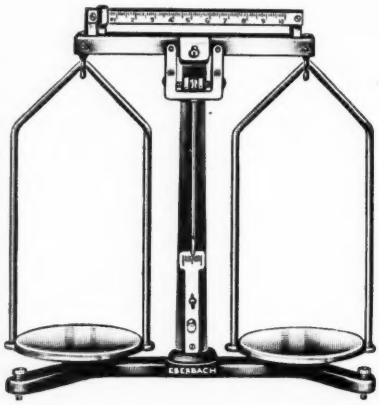
The Treasury Department acknowledges with appreciation the publication of this message by

PRODUCTS FINISHING

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and Advertising Council

Eberbach Utility Laboratory Balance

For weighing bulky samples where a capacity of 2 kilograms and an accuracy of 1/10 gram is required as with chemicals, metals, ceramics, and so on, the Eberbach & Son Co., Ann Arbor, Mich., has placed on the market the utility laboratory balance shown herewith. Designed for heavy duty without decreasing its fine sensitivity, the balance includes a beam that is said to combine rigidity with protection of knife edges and bearings from dust and mechanical injury. The beam has a single sliding weight and fixed scale, graduated to 10 grams in 1/10-gram subdivisions, thus eliminating the use of weights smaller than 1 gram. Bearings are agate.



Eberbach Utility Laboratory Balance

The pillar of the Eberbach Utility Laboratory Balance is equipped with a unique damping device with a graduated scale. According to the manufacturer, the construction of the equipment is such that the hangers cannot be lost or easily knocked off while operating the balance; in the process of assembly, they become an integral part of the beam.

The pans of the balance are 14 cm. in diameter and are made of nickel-plated brass. They are slightly concave; bows are 15 cm. wide x 30 cm. high. The total height of the balance is 42 cm.

Detrex Triad PR Spray Booth Compound

Triad PR, a protective coating for spray booth side walls, is announced by the Detrex Corp., Detroit 3, Mich. Readily applicable to the side walls of either wet or dry spray booths with a brush or spray gun, the coating provides a light-reflective finish that withstands mild abrasion. According to the manufacturer, this white brilliant surface improves visibility in the booth and can be easily flushed off with water or steam, carrying all surface deposits with it.

Triad PR is designed to aid in the speedy stripping of paint from conveyor hooks and spray booth louvers. The removal of frit in the vitreous enameling field is also one of the various other applications of the compound.

In addition, the company offers Triad WSF, a water conditioner for use in the water of wet spray booths. This material is said to remove the adhesive qualities from all types of paint and prevent the fouling or clogging of lines, pumps, nozzles, and other vital spray booth working parts by accumulated paint overspray.

Those Perfect Partners For Pickling

NEP and SUMFOAM

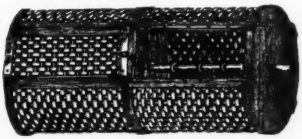
• TO SAVE ACID IN PICKLING •

• TO PREVENT FUMES •

THE WM. M. PARKIN CO. • 1102 HIGHLAND BLDG.

PITTSBURGH 6, PA.

Inexpensive, light in weight.
Easy to install and operate.



King White-Oak Plating Barrel

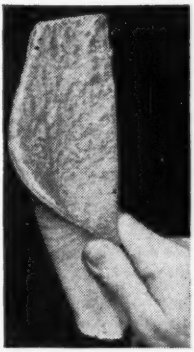
becomes a sub-anode, thereby producing a cleaner, brighter plate. Less plating time is required to put on the desired thickness of plate.

Send for catalogue and specification sheets.

JOHN KING 48 SPRINGFIELD ST. DAYTON 3, OHIO

LOOK AT THAT!

"That" is a load of overspray 3/8" thick, STRIPPED off a booth whose walls were protected with DOSTER BOOTH KOTE. It keeps booth walls clean. *Does not powder or flake.*



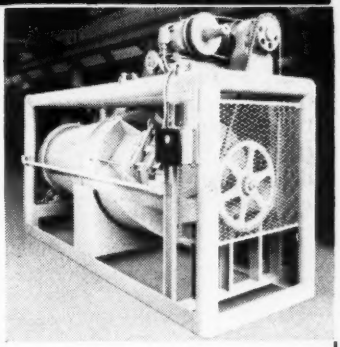
JUST DAUB IT ON—And, when loaded with overspray deposit—JUST STRIP IT OFF as easy as peeling a banana.

Stop worrying about your spray booths—send in today for 5 gals. of
DOSTER BOOTH KOTE
and prove its economy and superiority.
5 gallon Pails at $1.25 per gal. F. O. B.
DOSTER & CO.
4840-A W. Superior St. CHICAGO 44, ILL.

NEW HOWARD MACHINE SPEEDS PRODUCTION BURNISHING

Now Howard has combined all the features necessary for rapid, effective burnishing and polishing with brand new mass production methods. Parts are automatically separated on discharge. Here is another example of Howard Engineered jobs that save time, money and labor.

WRITE FOR NEW CATALOG
Machinery for Pickling—Tumbling—Deburring—Washing—Quenching—Drying—Burnishing



No. 365 New Howard Side-Loading, End-Discharge Burnishing Barrel. Parts are burnished rapidly and then separated automatically before automatic discharge.

HOWARD
HOWARD ENGINEERING & MANUFACTURING CO.
2237 BUCK STREET
CINCINNATI 14, OHIO

"Bunatol" 785 Plating Rack Insulation

Known as "Bunatol" 785, a thermoplastic air-drying insulation for plating racks is now being marketed by the Nelson J. Quinn Co., Toledo 7, Ohio. According to the manufacturer, only a few coats of the material are required in order to form a thick and tough insulation that stands up in the cleaner-copper-nickel-chrome cycle.

Bunatol 785 is readily applicable in a single tank, providing a smooth, glossy coating which, it is claimed, rinses freely, is chemically inert, and will not affect any plating solution. Additional advantages claimed for the material include thermal stability and permanent flexibility, thus eliminating cracking of the insulation when the plating rack is moved from a hot tank to a cold rinse tank. Moreover, the material is said to adhere firmly to bar copper as used in making racks, yet is simple to repair and is not toxic to workers using it.

Bunatol 785 is a low viscosity liquid into which plating racks can be rapidly dipped, with the resulting insulation forming no curtains or pockets, the manufacturer states.

FOUR IN ONE

Grinding and Polishing Machine

This type R machine is a combination of several types of grinding and polishing machines. It can be used for disc grinding—polishing—burring and surfacing.

Write for illustrated folder

PRODUCTION MACHINE CO.
GREENFIELD, MASS.

DC 804 Silicone Resin

The development of a thermosetting silicone resin for use in formulating exceptionally heat and moisture-resistant paints providing hard, mar-resistant surfaces is announced by the Dow Corning Corp., P. O. Box 592, Midland, Mich. Known as DC 804, the resin is especially recommended for use in formulating white finishes having properties between those of ceramic coatings and ordinary organic paints. According to the manufacturer, such finishes formulated with DC 804 do not become yellow or chalky with age as a result of the unusual resistance of the resin to moisture, oxidation, ozone, and ultra-violet radiation.

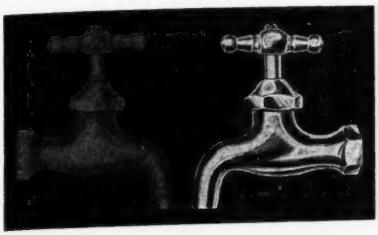
DC 804 is similar to previously-announced DC 803 except that it is said to form a considerably tougher film and require less baking to produce a harder and more mar-resistant surface. Like the other Dow Corning silicone resins (DC 801, DC 802, and DC 803), the new resin is claimed to be resistant to temperatures of 500 deg. F. and upward. If desired, DC 804 may be blended with DC 802 to produce finishes having various degrees of hardness and flexibility.

Oakite Composition No. 98

Designed for use primarily in pressure-spray washing machines, a self-emulsifying water-mixable solvent for removing light shop dirt and non-pigmented stamping compounds from steel and aluminum work, to be known as Oakite Composition No. 98, has been placed on the market by Oakite Products, Inc., 40 Thames St., New York 6, New York.

Non-toxic and non-flammable in solution, the material is reported to have important self-cleaning properties and employs the principle of "constant-float protection." The lighter-than-solution soil floats at the top of the cleaning tank to blanket and protect the clean solution underneath, retard foaming, and prevent material loss by evaporation. The "floating layer" is periodically skimmed or caused to overflow to avoid excessive thickening. The solvent is also said to prevent the formation on clean work of water spots which often show through clear lacquer and other types of organic finishes.

Recommended working concentrations for Oakite Composition No. 98 range from 1 to 2 per cent by volume, and maximum temperatures should not exceed 150 deg. Fahrenheit.



LUSTREBRIGHT

Bright Nickel Process

Produces Brilliant Adherent Nickel Deposits. Ideal Base for Chromium.

No color buffing • No re-cleaning • No re-racking • No special solutions. Merely add to cold nickel solution, still or mechanical • No extra equipment.

Guaranteed not to harm Nickel Solutions

Illustration shows unbuffed deposits before and after Lustrebright.

Write for complete information.

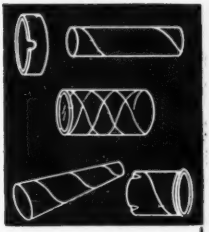
W. C. BRATE COMPANY

Established 1860

16 MARKET ST. ALBANY, N. Y.

Every Fine Little Unit **DESERVES this PROTECTION!**

PRECISION Dust Caps and Thread Protectors



In storage or transit. Save hunting for makeshifts. Protection inside and out, from rust, dust, grit, moisture and rough handling. For all shapes. Economically priced. Send for samples.

PRECISION PAPER TUBE CO.

2053 W. Charleston St. Chicago 47, Ill.

THE PERFECT COMBINATION

SWENSON

- **Infra Red Ovens**
- **Conveyors**
- **Dip Tanks**
- **Spray Booths**

SWENSON ENGINEERING & MANUFACTURING, *Inc.*

2615 TWELFTH ST., DETROIT 16, MICHIGAN

Sales Engineering Offices:

WAGNER-GREEN COMPANY
Cleveland 15, Ohio

J. K. MUNHALL COMPANY
Buffalo 2, New York

Puritan "Plastipak"

"Plastipak," a moisture, acid, and alkali protective coating that can be applied at room temperature to products by either the dip or spray method, has been announced by the Puritan Co., Inc., Rochester 6, New York.

Plastipak is a resinous compound that is said to dry quickly in air and form a clear, tough, elastic, transparent or colored film. According to the manufacturer, it adheres tenaciously to the product to which it is applied but can be quickly and easily stripped off in one continuous sheet when desired.

Plastipak can be applied to such metal parts as cutting tools, gears, drills, taps, axes, and cutlery, as well as to sheet metal, glass, porcelain, and other materials. In actual life tests, Plastipak is said to show no deterioration after exposures of long duration and to retain its transparency remarkably well. The high dielectric strength of the material is said to make it ideal for the radio and electrical fields since is provides both moisture protection and insulating properties.

Plastipak can be applied at room temperatures without the aid of special tanks or equipment and dries in air so that no forced drying is required. Easy to handle and simple to apply, Plastipak is designed to provide an efficient means for protecting and packaging all types of products—in process, in shipment, and in storage—against exposure to moisture, alkali, and acid conditions.

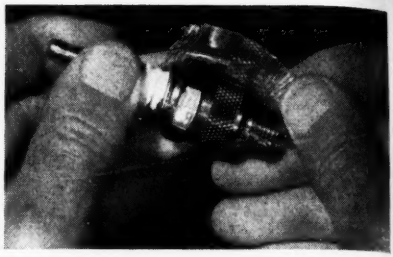


Illustration showing manner in which Puritan "Plastipak" can be removed from products in one continuous sheet

CUT DOWN REJECTS WITH ORVUS IN YOUR METAL CLEANING BATHS

This sulfated fatty alcohol Cleansing Agent is EFFECTIVE

—as a surface tension lowering agent

—as an emulsifier

—in dispersing lime soaps which might cause poor plating results if permitted to deposit on the metal

Write for further information about Orvus to

PROCTER & GAMBLE, Cincinnati, Ohio

"Filmite"

"Filmite," a non-drying film which is designed to prevent overspray from sticking to dry walls of paint spray booths, is now being marketed by The DuBois Co., 1120 W. Front St., Cincinnati 3, Ohio. The material, it is claimed, sets with a tough, thin outer "skin" that resists penetration. The "body" of the film is said to stay permanently soft so that accumulated overspray can be readily peeled off. Remaining Filmite (after stripping) can be washed off with water if desired, but affords a good base for the next coating.

According to the manufacturer, Filmite is non-toxic, non-irritant, non-inflammable, and non-corrosive and is supplied ready to use for spray or brush application.

Oakite Composition No. 92

Known as Oakite Composition No. 92, a heavy-duty alkaline-type detergent specially designed for use in modern steam guns and coil-type steam-generating mechanisms, has been announced by Oakite Products, Inc., 40 Thames St., New York 6, N. Y. The detergent is said to be particularly useful in cleaning machinery and equipment parts for subsequent repair and overhaul; preparing equipment surfaces for repainting or re-

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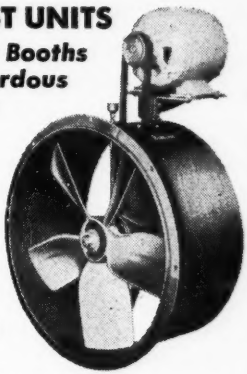

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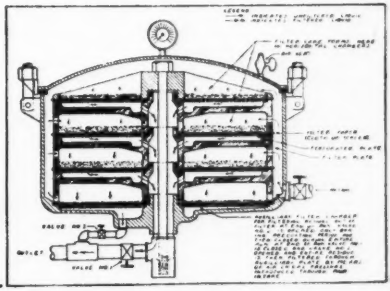

SPARKLER MANUFACTURING CO.

SPARKLER HORIZONTAL PLATE FILTERS

255 LAKE ST., MUNDELEIN, ILL.

finishing; cleaning equipment too large for tank immersion or where suitable tanks are not available; paint stripping and other cleaning operations.

Oakite Composition No. 92 is described as providing a highly thorough and fast steam-cleaning action at very low concentrations. Specialized advantages associated with the product by the manufacturer include the prevention of scale clogs in steam coils; ready dissolution in hot water; free-rinsing action on all surfaces; and safe and pleasant handling without offensive fumes or toxic vapors.

"Spectrifier" Full-Wave Selenium Rectifier

A full-wave selenium rectifier with input of 110 volts, 60-cycle single-phase a.c. and output of 6 volts, 100 amperes is now being marketed by the Special Chemicals Corp., 30 Irving Place, New York 13, N. Y. Designated as the "Spectrifier," the unit is designed for plugging directly into any ordinary light circuit and draws 10 amperes.

Especially suited to chromium and rhodium plating, the Spectrifier can be used for all electroplating operations and is provided with double protection from overload by both an automatic 50 per cent overload cutout relay circuit breaker and by fuses. Back voltage is claimed to be eliminated. Additional construction features of the unit include an electrolytic self-healing condenser, voltmeter and ammeter scales which are said to far exceed requirements, and a tell-tale on-and-off light. The steel cabinet is provided with a handsome spray finish.

"Spectrifier" Full-Wave Selenium Rectifier

A single control on the front of the cabinet enables any output from zero to full capacity to be readily attained. To increase power rating in accordance with conventional practice, units may be combined.

M & W "Motletone"

A coating which is designed to produce a lustrous hammered effect in a single spray-coat application is announced by the Maas & Waldstein Co., 438 Riverside Ave., Newark 4, N. J. The product, which is known as "Motletone," is available as an air-dry or baking finish.

Motletone may be used on metal equipment such as automobile heaters, air conditioning units, and metal furniture. It may also be used on molded plastic products when a metal-like hammered finish is desired. According to the manufacturer, the coating tends to hide weld dimples, scratches, and other small de-

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fects, and is especially recommended where economical finishing is required.

Pennsalt A-22 and PM-95 Metal Cleaners

The production of two metal cleaners designated as Pennsalt A-22 and Pennsalt PM-95 are announced by the Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pennsylvania.

Pennsalt Cleaner A-22 is a general-purpose soak tank cleaner for use on all aluminum alloys. Most common applications are cleaning aluminum before anodizing, chromodizing, phosphatizing, and other prepainting treatment and before deoxidizing and subsequent spot welding.

Pennsalt PM-95 is a specially prepared cleaning and descaling compound containing additional agents for surface action and inhibition. Suggested uses are general pickling and metal descaling, especially for difficult-to-remove oxides resulting from heat treating or annealing.

"Hyprez" Diamond Compound

A scientifically prepared diamond compound for fine grinding, lapping, and polishing is now being marketed under the name of "Hyprez" by the Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill., and the Sapphire Products Division of Elgin National Watch Co., 932 Benton St., Aurora, Ill. According to the manufacturer, the diamond particles are exactly graded to definite standard specifications and are evenly distributed and permanently suspended.

Hyprez Diamond Compound is recommended for many finishing operations on metals, sintered carbides, sapphire, and other hard materials. Die and mold work, gage and instrument production, industrial jewel and gem stone manufacture are some of the fields in which the compound is readily applicable.

To assure uniform and economic performance on the job, the compound is supplied in a wide variety of grades, each of which is readily identified by a distinguishing color. The compound is furnished in clear Pyrex cartridges which are designed to fit into syringe-type applicators that are constructed to fully protect the compound from dust, dirt,

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and grit and to allow for the easy application of metered amounts of the compound to the work in a flat ribbon.

Industrial Lining Service

Industrial Lining Engineers, Inc., Edgeworth, Pa., is now offering a lining service for industrial and process equipment. The firm has as its function that of specifying and assisting in the application of the particular type of lining selected from the diversified field of lining materials best suited to solve the particular problem at hand.

Linings employed include the following types of materials applied as film, sheet, or troweled linings: Bakelite, Vinyls, Polystrene, Polyethylene, Velite, GR-S Synthetic rubber, GR-N Synthetic rubber, Butyl Rubber, Neoprene, and Thiokol. Combinations of these materials are sometimes necessary in order to obtain the desired lining characteristics.

Among the equipment which can be provided with the protective coatings and linings are air conditioning equipment, electroplating tanks and racks, hot water tanks, tank cars, bleach tanks, pickle tanks, mine equipment, and so on.

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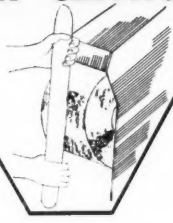

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INDUSTRIAL LUBRICANTS CO., INC.
5736 TWELFTH ST DETROIT 8, MICH.

Hammond Abrasive Belt Grinders. An eight-page bulletin prepared by Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich., features complete descriptions, illustrations, and specifications regarding the Hammond Vertical-Horizontal 6-Inch Abrasive Belt Grinder for grinding, polishing, deburring, beveling, and similar operations on metals, plastics, ceramics, and so on; Hammond No. 5 Abrasive Belt Grinder-Polisher for grinding, polishing, buffing, deburring, brushing, and many other similar operations; and Hammond Floor Model F-2 Flexible Belt Grinder for toolrooms, machine shops, production departments, maintenance and sheet metal shops, and so on.

In addition, the bulletin presents data regarding various other Hammond Abrasive Belt Grinders for a wide variety of finishing operations, as well as Hammond Backstands for converting existing grinding and polishing equipment into high production machines using abrasive belts for a wide variety of finishing jobs. Copy of Bulletin 310 free upon request.

Modern Organic Finishes. By Rollin H. Wampler. Published by Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. 445 pages. Illustrated. Cloth binding, board covers. Price, $10.00.

This book is primarily one of methods. Descriptions of modern finishing materials and equipment for their application, drying, and conveying are presented so that the reader may have an over-all picture of modern industrial finishing operations. Throughout, the main emphasis is on proper selection and use of materials and equipment to obtain the best possible finish at minimum cost.

The author's aim is to acquaint the manufacturer with materials and equipment now available and to describe efficient practices and typical procedures for finishing certain articles. In the light of this knowledge, the reader can then correctly solve his finishing problems and select and use the materials and equipment best suited to his needs.

The contents of the book are divided into six major sections which are headed as follows: Modern Organic Finishing Materials; Modern Application Methods; Drying Methods; Product Handling in the Finishing Department; Finishing Processes; and Some General Considerations. A bibliography and index are included at the rear of the book.

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This equipment is now plating millions of pieces each year with a minimum amount of labor but must be replaced to accommodate greatly expanded production.

Sale of equipment as complete unit is preferred but will sell individual items if desired. Inspection of the unit actually in operation is invited. Location: Indiana.

Address P. O. Box 871 **Aurora, Illinois**

Ahcoloid Metal Cleaning Compounds are the subject of an eight-page illustrated booklet prepared by the Apothecaries Hall Co., Waterbury 88, Conn. The purpose of the booklet is to provide a broad picture of methods and materials for the cleaning of various types of metal parts, including cleaners for soak tanks, electrocleaning, power washers, burnishing and barrel cleaning. Copy free upon request.

"Prufcoat," a material for application to all concrete, structural steel, floors, pipes, tanks, and machinery for protection against acids, alkalies, oil, and water, is the subject of a 12-page fully illustrated and documented booklet now being distributed by Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass. Case histories of the coating, as well as full directions for applying same by the brush, spray gun, or dip method, are included in the booklet, copy of which is available free upon request.

"Columbia" Activated Carbon. Of interest to those requiring activated carbon for solvent recovery, for purification of air or gas, or as a catalyst carrier is a booklet on "Columbia" Activated Carbon which is now being issued by the Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York 17, N. Y. Specifications as well as suggested applications of the material are described in the booklet, copy of which is available free by requesting Form 4712.

Kelite Metal Processing Bulletin. Kelite Products, Inc., P. O. Box 2917 Terminal Annex Station, Los Angeles 54, Calif., has published a 12-page bulletin presenting illustrated and descriptive information regarding the pH controlled cleaning methods and materials made available by the company for the metal industries. Many cleaning problems encountered in metal processing and finishing operations are illustrated and discussed briefly. Cleaning materials for various kinds of metals, including aluminum, brass, copper, die-cast and ferrous metals, are also discussed.

In addition, the bulletin covers Kelite's suggestion service as an aid in the planning or supervision of new production cleaning systems or in reorganizing and modifying old ones, and also Kelite's control service reports which are designed to keep managers and superintendents advised as to the function and efficiency of their cleaning and processing operations. Copy free upon request.

"Hints on Preparing Metal for Painting" is the title of a six-page illustrated bulletin issued by the Neilson Chemical Co., 6564 Benson St., Detroit 7, Mich. Intended for the use of paint companies and their technical staffs, salesmen, and field service men, the bulletin affords a comprehensive treatise on preparing aluminum alloys, zinc-coated surfaces, lead-coated surfaces, cadmium-plated surfaces, and ferrous metals for painting by the use of brushing, dipping, and washing methods. Copy of Bulletin 46-60 free upon request.

The Finishing Touch — **By J. A. Patterson**

"But boss, th' cord's busted and Cornish says he don't mind at all."